

INSTALLATION RESTORATION PROGRAM

FINAL

Installation Restoration Program Site Investigation Report

183rd Fighter Group
Illinois Air National Guard, Capital Airport
Springfield, Illinois

FEBRUARY 1996

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FINAL

**INSTALLATION RESTORATION PROGRAM
SITE INVESTIGATION REPORT**

**183rd FIGHTER GROUP
ILLINOIS AIR NATIONAL GUARD, CAPITAL AIRPORT
SPRINGFIELD, ILLINOIS**

Submitted to the

**AIR NATIONAL GUARD READINESS CENTER
ANDREWS AFB, MARYLAND**

Submitted by the

**HAZARDOUS WASTE REMEDIAL ACTIONS PROGRAM
MARTIN MARIETTA ENERGY SYSTEMS, INC.
Oak Ridge, Tennessee 37831**

for the

U.S. DEPARTMENT OF ENERGY

Prepared by

**THE EARTH TECHNOLOGY CORPORATION
Oak Ridge, Tennessee 37830**

FEBRUARY 1996

TABLE OF CONTENTS

ACRONYMS AND ABBREVIATIONS	xi
EXECUTIVE SUMMARY	S-1
1.0 INTRODUCTION	1-1
1.1 PURPOSE OF THE INSTALLATION RESTORATION PROGRAM	1-1
1.2 PURPOSE OF THE SITE INVESTIGATION	1-2
1.3 REPORT ORGANIZATION	1-3
1.4 BASE BACKGROUND	1-4
1.4.1 Base History	1-4
1.4.2 Site Descriptions	1-4
1.4.2.1 <u>Site 1 - POL Storage Area</u>	1-4
1.4.2.2 <u>Site 2 - Old Fire Training Area</u>	1-8
1.5 PREVIOUS PROGRAM ACTIVITIES	1-8
1.6 REGIONAL GEOLOGIC SETTING	1-9
2.0 FIELD PROGRAM	2-1
2.1 FIELD PROGRAM SUMMARY	2-1
2.2 GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIONS	2-1
2.2.1 Static Groundwater Measurements	2-2
2.2.2 Aquifer Testing	2-2
2.2.3 Geotechnical Analyses	2-2
2.2.4 Piezometer Installation	2-3
2.3 FIELD SCREENING SAMPLING AND ANALYSIS	2-3
2.3.1 Initial Site Screening Activities	2-4
2.3.1.1 <u>Sampling Methods - Initial Site Screening</u>	2-4
2.3.1.2 <u>Analytical Methods - Initial Site Screening</u>	2-5
2.3.2 On-Site GC Screening of Soil Samples	2-7
2.4 DECONTAMINATION PROCEDURES	2-8
2.5 SAMPLING FOR FIXED-BASE LABORATORY ANALYSIS	2-8
2.5.1 Soil Sampling Activities	2-9
2.5.1.1 <u>Soil Sampling (Drill Rig)</u>	2-9
2.5.1.2 <u>Hand-Augered Soil Sampling</u>	2-9
2.5.2 Surface Water/Sediment Sampling Activities	2-9
2.5.3 Monitoring Well Installation, Development and Sampling	2-11
2.5.3.1 <u>Monitoring Well Installation</u>	2-11
2.5.3.2 <u>Monitoring Well Development</u>	2-11
2.5.3.3 <u>Groundwater Sampling and Analysis</u>	2-12
2.6 BACKGROUND SAMPLING RESULTS	2-12
2.7 SURVEYING	2-12
2.8 DISPOSAL OF WASTES AND SOIL CUTTINGS FROM FIELD ACTIVITIES	2-12
3.0 SIGNIFICANCE OF RESULTS	3-1
3.1 BASE GEOLOGY AND HYDROGEOLOGY	3-1
3.1.1 Geology	3-1
3.1.2 Base Hydrogeology	3-2
3.2 QA/QC INTRODUCTION	3-4

3.2.1	Data Quality Objectives	3-4
3.2.1.1	<u>Precision</u>	3-5
3.2.1.2	<u>Accuracy</u>	3-20
3.2.1.3	<u>Representativeness</u>	3-23
3.2.1.4	<u>Comparability</u>	3-24
3.2.1.5	<u>Completeness</u>	3-24
3.3	FIELD QUALITY CONTROL ASSESSMENT	3-24
3.3.1	Trip Blanks	3-24
3.3.2	Field Blanks	3-25
3.3.3	Equipment Rinseates	3-25
3.3.4	Field Replicates	3-25
3.4	LABORATORY QUALITY CONTROL ASSESSMENT	3-26
3.5	BACKGROUND SOILS SAMPLING	3-27
3.6	SITE 1: POL STORAGE AREA	3-34
3.6.1	Site Geology and Hydrogeology	3-34
3.6.2	Screening Activity Results	3-39
3.6.2.1	<u>Grab-Type Soil and Groundwater Screening Results</u>	3-39
3.6.2.2	<u>Field GC Screening Results</u>	3-39
3.6.3	Confirmation and Delineation Results	3-40
3.6.3.1	<u>Surface Soil Samples</u>	3-41
3.6.3.2	<u>Subsurface Vadose Zone Soil Samples</u>	3-47
3.6.3.3	<u>Groundwater Samples</u>	3-51
3.6.3.4	<u>Conclusions</u>	3-61
3.7	SITE 2 - OLD FIRE TRAINING AREA	3-64
3.7.1	Site Geology and Hydrogeology	3-65
3.7.2	Screening Activity Results	3-71
3.7.2.1	<u>Soil Gas, Soil, and Groundwater Screening Results</u>	3-71
3.7.2.2	<u>Field GC Screening Results</u>	3-73
3.7.3	Confirmation and Delineation Results	3-73
3.7.3.1	<u>Surface Soils</u>	3-74
3.7.3.2	<u>Subsurface Soil Samples</u>	3-80
3.7.3.3	<u>Sediment Samples</u>	3-87
3.7.3.4	<u>Surface Water Samples</u>	3-87
3.7.3.5	<u>Groundwater Samples</u>	3-91
3.7.4	Conclusions	3-101
3.7.4.1	<u>Summary</u>	3-101
3.7.4.2	<u>Conclusions</u>	3-102
4.0	PRELIMINARY RISK EVALUATION	4-1
4.1	PRELIMINARY HUMAN HEALTH EVALUATION	4-1
4.1.1	Identification of Chemicals of Potential Concern	4-1
4.1.1.1	<u>Site 1: POL Storage Area</u>	4-1
4.1.1.2	<u>Site 2 - Former Fire Training Area</u>	4-5
4.1.2	Exposure Assessment	4-16
4.1.2.1	<u>Characterization of Exposure Setting</u>	4-16
4.1.2.2	<u>Exposure Pathways</u>	4-17
4.1.3	Toxicity Assessment	4-19
4.1.4	Risk Screening	4-21
4.1.4.1	<u>Site 1 - POL Storage Area</u>	4-21
4.1.4.2	<u>Site 2 - Old Fire Training Area</u>	4-21
4.2	ECOLOGICAL RISK EVALUATION	4-22

4.2.1 Summary of Analytical Data Used in the Ecological PRE	4-22
4.2.2 Identification of Potential Receptors	4-22
4.2.2.1 <u>Site 1 - POL Storage Area</u>	4-22
4.2.2.2 <u>Site 2 - Old Fire Training Area</u>	4-23
4.2.3 Ecological Exposure Pathways	4-23
4.2.3.1 <u>Site 1 - POL Storage Area</u>	4-23
4.2.3.2 <u>Site 2 - Old Fire Training Area</u>	4-23
4.2.4 Ecological Hazard Assessment	4-24
4.3 SUMMARY OF THE PRELIMINARY HUMAN HEALTH AND ECOLOGICAL EVALUATION	4-24
5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	5-1
5.1 SUMMARY AND CONCLUSIONS	5-1
5.1.1 Geology and Hydrogeology	5-1
5.1.2 Quality Assurance/Quality Control	5-1
5.1.3 Site 1: POL Storage Area	5-2
5.1.4 Site 2: Old Fire Training Area	5-2
5.2 RECOMMENDATIONS	5-3
5.2.1 Site 1: POL Storage Area	5-3
5.2.2 Site 2: Old Fire Training Area	5-3
6.0 BIBLIOGRAPHY	6-1

APPENDICES

- A Field Change Request Forms
- B Groundwater Elevation Measurements and Aquifer Test Data
- C Boring Logs, Geotechnical Data, and Well Construction Forms
- D Soil Gas, Groundwater, and Soil Screening Results
- E On-site Field GC Soil Analytical Results
- F quality assurance/quality control Evaluation
- G Fixed-base Laboratory Data Validation Summaries and Data
- H Groundwater Development and Soil and Groundwater Sampling Forms
- I Surveying Data
- J Investigation Derived Waste: Analytical Results

LIST OF FIGURES

Figure 1-1	Location of the 183rd FG and Sites 1 and 2	1-5
Figure 1-2	Site 1-POL Storage Area	1-6
Figure 1-3	Site No. 2-Old FTA	1-7
Figure 1-4	Surface Water Drainage Map	1-10
Figure 1-5	Generalized Stratigraphic Section of Illinois	1-11
Figure 1-6	Generalized Cross Section of the Unconsolidated Sediments at the Base and Vicinity	1-13
Figure 3-1	Location of Facility Background Soil Borings	3-31
Figure 3-2	Site 1-POL Storage Area Sample Location Map	3-32
Figure 3-3	Site 1-Lines of Cross Section	3-33
Figure 3-4	Site 1 Cross Section A-A ¹	3-35
Figure 3-5	Site 1 Cross Section B-B ¹	3-37
Figure 3-6	Site -POL Storage Area Groundwater Elevation Map	3-38
Figure 3-7	Site 1: Surface Soil Analytical Data Summary	3-46
Figure 3-8	Site 1: Subsurface Soil Analytical Data Summary	3-50
Figure 3-9	Site 1: Groundwater Analytical Data Summary	3-60
Figure 3-10	Site 1 Cross Section A-A ¹ BTEX Concentrations	3-62
Figure 3-11	Site 1 Cross Section B-B ¹ BTEX Concentrations	3-63
Figure 3-12	Site 2 Soil Boring, Well, Piezometer and Fixed Base Analytical Sample Locations	3-66
Figure 3-13	Site 2 - Lines of Cross Section	3-67
Figure 3-14	Site 2 Cross Section 2A-2A ¹	3-68
Figure 3-15	Site 2 Cross Section 2B-2B ¹	3-69
Figure 3-16	Site 2 Groundwater Elevation Map	3-70
Figure 3-17	Site 2 SOV Survey, Grab-Type Soil and Groundwater Screening Results - Total VOCs (µg/L)	3-72
Figure 3-18	Site 2: Surface Soil and Sediment Analytical Data Summary	3-79
Figure 3-19	Site 2: Subsurface Soil Analytical Data Summary	3-86
Figure 3-20	Site 2: Groundwater and Surface Water Analytical Data Summary	3-94
Figure 3-21	Site 2 Cross Section 2A-2A ¹ BTEX Concentrations	3-104
Figure 3-22	Site 2 Cross Section 2B-2B ¹ BTEX Concentrations	3-105

LIST OF TABLES

Table 1-1	Site Hazard Assessment Scores, ILANG, 183RD FG, Capital Airport, Springfield, Illinois	1-8
Table 1-2	Springfield Climate Statistics	1-12
Table 2-1	Summary of Site Investigation Field Program 183rd FG, ILANG, Springfield, Illinois	2-1
Table 2-2	Laboratory Analytical Methods Summary 183rd FG, Capital Airport, Springfield, Illinois	2-10
Table 3-1	Geotechnical Properties of Site 1 and 2 Soils	3-2
Table 3-2	Well Construction and Water Level Elevations, ILANG, 183rd FG, Springfield, Illinois	3-3
Table 3-3	Sampling and Analysis Summary ILANG, Capital Airport, Springfield, Illinois ..	3-5
Table 3-4	Laboratory Quality Control Summary: Water MS/MSD Volatile Organic Compounds ILANG, Capital Airport, Springfield, Illinois	3-7
Table 3-5	Laboratory Quality Control Summary: Soil MS/MSD Volatile Organic Compounds ILANG, Capital Airport, Springfield, Illinois ..	3-11
Table 3-6	Laboratory Quality Control Summary: Water MS/MSD Semivolatile Organic Compounds ILANG, Capital Airport, Springfield, Illinois	3-15
Table 3-7	Laboratory Quality Control Summary: Soil MS/MSD Semivolatile Organic Compounds ILANG, Capital Airport, Springfield, Illinois	3-16
Table 3-8	Laboratory Quality Control Summary: Water MS/MSD Pesticides/ PCB ILANG, Capital Airport, Springfield, Illinois	3-17
Table 3-9	Laboratory Quality Control Summary: Soil MS/MSD Pesticides/ PCB ILANG, Capital Airport, Springfield, Illinois	3-18
Table 3-10	Laboratory Quality Control Summary: Water MS/MSD Metals ILANG, Capital Airport, Springfield, Illinois	3-22
Table 3-11	Laboratory Quality Control Summary: Soil MS/MSD Metals ILANG, Capital Airport, Springfield, Illinois	3-19
Table 3-12	Data Summary Table: Surface Soil - Facility Background Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	3-28
Table 3-13	Data Summary Table: Subsurface Soil - Facility Background Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	3-30
Table 3-14	Field GC Analytical Results - Site 1 POL Storage Area ILANG, Capital Airport, Springfield, Illinois	3-40
Table 3-15	Data Summary Table: Surface Soils - Site 1 POL Storage Area Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	3-42
Table 3-16	Data Summary Table: Subsurface Soils - Site 1 POL Storage Area Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	3-48
Table 3-17	Data Summary Table: Groundwater - Site 1 POL Storage Area Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	3-52
Table 3-18	Field GC Analytical Results - Site 2 Old Fire Training Area ILANG, 183rd FG, Capital Airport, Springfield, Illinois	3-73
Table 3-19	Data Summary Table: Surface Soils - Site 2 Old Fire Training Area Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	3-75
Table 3-20	Site 2 Old Fire Training Area - Surface Soils and Background Inorganics Comparison - Illinois Air National Guard, 183rd FG, Capital Airport Springfield, Illinois	3-81
Table 3-21	Data Summary Table: Subsurface Soils - Site 2 Old Fire Training Area Illinois Air National Guard, 183rd FB, Capital Airport, Springfield, Illinois	3-82

Table 3-22	Site 2 Old Fire Training Area - Subsurface Soils and Background Subsurface Inorganics Comparison - Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	3-88
Table 3-23	Data Summary Table: Sediment - Site 2 Old Fire Training Area Illinois Air National Guard, 183rd FB, Capital Airport, Springfield, Illinois	3-89
Table 3-24	Data Summary Table: Surface Water - Site 2 Old Fire Training Area Illinois Air National Guard, 183rd FB, Capital Airport, Springfield, Illinois	3-92
Table 3-25	Data Summary Table: Groundwater - Site 2 Old Fire Training Area Illinois Air National Guard, 183rd FB, Capital Airport, Springfield, Illinois	3-95
Table 4-1	Site 1 POL Storage Area Contaminant Distribution - Surface Soils ILANG, 183rd FG, Capital Airport, Springfield, Illinois	4-2
Table 4-2	Site 1 POL Storage Area Contaminant Distribution - Subsurface Soils ILANG, 183rd FG, Capital Airport, Springfield, Illinois	4-3
Table 4-3	Site 1 POL Storage Area Contaminant Distribution - Groundwater ILANG, 183rd FG, Capital Airport, Springfield, Illinois	4-4
Table 4-4	Site 2 Old Fire Training Area Contaminant Distribution - Surface Soils Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	4-6
Table 4-5	Site 2 Old Fire Training Area Contaminant Distribution - Subsurface Soils Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois	4-8
Table 4-6	Old Fire Training Area Contaminant Distribution - Groundwater ILANG, 183rd FG, Capital Airport, Springfield, Illinois	4-10
Table 4-7	Site 2 Old Fire Training Area Contaminant Distribution - Surface Water ILANG, 183rd FG, Capital Airport, Springfield, Illinois	4-13
Table 4-8	Site 2 Old Fire Training Area Contaminant Distribution - Sediments ILANG, 183rd FG, Capital Airport, Springfield, Illinois	4-14
Table 4-9	Carcinogenic Classification and Cancer Risk Estimates ILANG, 183rd FG, Capital Airport, Springfield, Illinois	4-20

ACRONYMS AND ABBREVIATIONS

ANG	Air National Guard
ANGRC	Air National Guard Readiness Center
ARARs	Applicable or Relevant and Appropriate Requirements
ASTM	American Society for Testing and Materials
AWQC	Ambient Water Quality Criteria
b	aquifer thickness
B	blank contamination
BCE	Base Civil Engineer
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylene
CE	Civil Engineering
CEC	cation exchange capacity
CL	clay
CLP	contract laboratory program
COC	chain of custody
COPC	chemical of potential concern
CRDL	Contract Required Detection Limits
CRQL	Contract Required Quantitation Limits
DCB	1,4-dichlorobenzene
DCE	dichloroethene
DD	Decision Document
DOD	Department of Defense
DQOs	data quality objectives
DOE	Department of Energy
Earth Technology	The Earth Technology Corporation
ECD	electron capture detector
EPA	Environmental Protection Agency
Energy Systems	Lockheed Martin Energy Systems
FID	flame ionization detector
FFS	Focused Feasibility Study
FG	Fighter Group
FM	formations
FS	Feasibility Study
FSP	Field Sampling Plan
FTA	Fire Training Area
GC	gas chromatograph
GC/MS	gas chromatography/mass spectrometry
HARM	Hazardous Assessment Rating Methodology
HAZWRAP	Hazardous Waste Remedial Actions Program
HMTC	Hazardous Materials Technical Center

ID	inner diameter
ILANG	Illinois Air National Guard
IEPA	Illinois Environmental Protection Agency
IRP	Installation Restoration Program
JP-4	Petroleum Jet Fuel #4
K	hydraulic conductivity
LCS	laboratory control sample
LQL	lower quantifiable limit
MCL	maximum contaminant level
MDL	minimum detection limit
mg/L	milligrams/liter
mg/kg	milligrams/kilogram
ml	milliliter
MS/MSD	matrix spike/matrix spike duplicate
MSL	mean seal level
n	porosity
NCP	National Contingency Plan
OD	outside diameter
PA	Preliminary Assessment
PAH	polynuclear aromatic hydrocarbon
PARCC	Precision, Accuracy, Representativeness, Comparability, and Completeness
PCB	polychlorinated biphenyls
PCE	tetrachloroethylene
PID	photoionization detector
POL	petroleum, oil, and lubricant
PP	Priority Pollutant
ppb	parts per billion
PRE	Preliminary Risk Evaluation
PVC	polyvinyl chloride
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Program Plan
QC	quality control
RCRA	Resource Conservation and Recovery
RD	Remedial Design
RI	Remedial Investigation
RM	remedial measure
RPD	Relative Percent Difference
SAA	Springfield Airport Authority
SAP	Sampling and Analysis Plan

SARA	Superfund Amendments and Reauthorization Act
SCITEK	Science and Technology
SI	Site Investigation
SOP	Standard Operating Procedure
SOV	soil organic vapor
SOW	Statement of Work
SVOCs	semivolatile organic compounds
T	transmissivity values
TAL	Target Analyte List
TCA	trichloroethane
TCE	trichloroethene
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbon
TVOC	total volatile organic compound
µg/l	micrograms per liter
µg/kg	micrograms per kilogram
µm	micrometer
USAF	U.S. Air Force
USCS	Unified Soil Classification System
USEPA	United States Environmental Protection Agency
UST	underground storage tank
v	groundwater velocity
VOCs	volatile organic compounds
WP	Work Plan
%R	percent recovery

**SITE INVESTIGATION REPORT
183rd FIGHTER GROUP
ILLINOIS AIR NATIONAL GUARD, CAPITAL AIRPORT
SPRINGFIELD, ILLINOIS**

EXECUTIVE SUMMARY

This Site Investigation (SI) Report documents activities The Earth Technology Corporation performed at the Illinois Air National Guard (ILANG), 183rd Fighter Group (FG), Capital Airport, Springfield, Illinois under the U.S. Department of Defense Installation Restoration Program. Two sites, Site 1 - Petroleum, Oil, and Lubricant (POL) Storage Area and Site 2 - Old Fire Training Area (FTA), were identified at ILANG, Capital Airport during the Preliminary Assessment (PA) begun by the Dynamac Corporation through the Hazardous Materials Technical Center and completed by Science and Technology in May 1990. Site 1 is located within the base boundaries, while Site 2 is located off-base on Springfield Airport Authority (SAA) property. The SI was conducted to:

- Confirm the presence or absence of contamination at the sites
- Identify the sources and nature of contamination at the sites
- Provide a preliminary assessment of the extent, magnitude, and movement of contamination
- identify the potential threat of contamination to human health or the environment

Site 1 - POL Storage Area consists of four 25,000 gallon petroleum jet fuel underground storage tanks (USTs) located on the northwest side of the base. A spill occurred at the POL storage area in the late 1950s when a fuel transfer pump leaked approximately 3,100 gallons of jet fuel onto the ground. Site 2 - FTA is located off-base on SAA property. The FTA was utilized for fire training operations twice a month from 1949 to 1974 by base and airport personnel. A variety of flammable liquids including jet fuels, paints, paint strippers, and solvents were reportedly used during the training exercises.

FIELD PROGRAM

The major portion of the field effort, including soil gas sampling; drilling soil borings; installing monitoring wells; soil, sediment, surface water and groundwater sampling; and aquifer testing was conducted from November 16 to December 8, 1992. The second round of groundwater sampling was conducted from April 12 to April 21, 1993.

SIGNIFICANCE OF RESULTS

SI results for Site 1 confirmed that soil and groundwater contamination related to petroleum fuel releases or spills exists at the site. Seventeen surface and subsurface soil samples were collected at Site 1. Benzene, toluene, ethylbenzene, and xylene (BTEX) compounds are not present at levels

above the Illinois Leaking Underground Storage Tank (LUST) Type A soil cleanup objectives. Polynuclear aromatic hydrocarbons (PAHs), both carcinogenic and noncarcinogenic compounds, occur in the surface and subsurface soil samples at levels above the Illinois LUST Type A soil cleanup objectives. Six of the nine surface soil samples contain lead in concentrations greater than 15.1 mg/kg, the upper range of the background surface soil samples. Lead in the subsurface soils does not appear elevated when compared to background concentrations.

Four groundwater monitoring wells were installed at Site 1. BTEX compounds were detected in MW104 at relatively low concentrations, and below any applicable federal and state regulatory limits. Naphthalene (3 to 11 ppb) was detected in groundwater collected and analyzed from MW104 during both rounds of sampling. Concentrations of lead in the groundwater are comparable to what was found in the sites up-gradient well.

SI results for Site 2 confirmed that soil and groundwater contamination related to past fire training exercises exists at the site. Screening activities identified an area in the subsurface containing high volatile organic compounds (VOCs) at approximately the same location identified as the burn pit area by areal photographs and base and SAA personnel.

The Site 2 surface and subsurface vadose zone soils appear to be composed predominately of fill material. The fill probably was placed at the site as a result of the 1989 aircraft parking apron construction activities. Fuel-related soil contamination was identified in two soil borings: SB206 (BTEX 84,000 ppb) and SB207 (BTEX 1,210 ppb). Polychlorinated biphenyls were detected in three surface and subsurface soils at concentrations ranging from 770 to 2800 ppb. Concentrations of the metals arsenic, barium, thallium, and zinc were detected above background in the surface soils at the site. Concentrations of metals in the subsurface soils were not elevated when compared to background subsurface soil results.

Three surface water and three sediment samples were collected from the pond at Site 2. The three sediment samples contain PAHs (92 to 2,373 ppb) and 1,4-dichlorobenzene (70 to 130 ppb). Metals concentrations do not appear to be elevated when compared to background soil concentrations. No organic compounds were detected in the three surface water samples collected from the pond. Antimony was detected in one unfiltered surface water sample at 14 ppb. No other metals appeared to be elevated.

The Site 2 up-gradient well (MW201) and the most down-gradient well (MW203) contain minor concentrations (less than 1 ppb) of organic compounds. Well MW202, installed between the burn pit and the pond, contains BTEX and a variety of chlorinated and other nonchlorinated compounds. Vinyl chloride, cis-1,2-dichloroethene, and lead were detected in this well at concentrations exceeding state or federal applicable or relevant and appropriate requirements (ARARs). Based on the surface topography and the assumed shallow groundwater flow regime that may exist beneath the pond, contaminants may be migrating off airport property to the southeast.

PRELIMINARY RISK EVALUATION

A preliminary risk evaluation (PRE) was conducted at both sites to evaluate the potential for adverse health effects. The PRE at Site 1 indicated that no immediate endangerment to human health or the environment exists due to the presence of chemicals in the soils or groundwater at the site. Based on the results of the SI, the groundwater contamination has not migrated from the site and the contaminant concentrations in the groundwater do not exceed ARARs. This evaluation suggests

that there does not appear to be any immediate threats to down-gradient drinking water wells or surface water bodies. Exposure to surface soils may occur during vegetation control; however, the major exposure would occur in the future if construction/excavation activities take place at Site 1.

The initial PRE at Site 2 indicated that shallow domestic groundwater supplies, down-gradient (southeast) of Site 2, may be adversely impacted by contaminant releases from past fire training exercises. Immediate response measures were taken to evaluate if contaminants from the FTA were migrating off-site and to provide alternative water sources for the residents in the area. Off-site residential wells were sampled during the summer of 1993 and again in the fall of 1993 and the residents placed on city water supply. The residential wells southeast of Site 2 were abandoned in the spring of 1994. Exposure to surface soils may occur during vegetation control; however, the major exposure would occur in the future if construction/excavation activities take place at Site 2. The worst-case scenario for ecological risk indicates that aquatic life present in the ponds would be at risk if the surface water contaminant concentrations approach the groundwater contaminant concentrations.

RECOMMENDATIONS

The USTs at Site 1 will ultimately be removed from the site. No further action is recommended before proceeding with the UST removal. If allowed under the Illinois LUST regulations, or necessary for groundwater remediation design, piezometer PZ104 could be sampled to quantify VOC, semivolatile organic compounds, and lead concentrations in the groundwater near the tankpit area. The existing site monitoring wells are well placed to monitor the down-gradient movement of the dissolved hydrocarbon plume existing in the shallow groundwater.

It is recommended that a Remedial Investigation be performed at Site 2 to define the extent of soil and groundwater contamination that exists at the site. Down-gradient domestic groundwater users have been transferred to a city water supply and plans made for abandonment of the drinking wells; therefore, an immediate health threat is no longer present.

1.0 INTRODUCTION

This report documents the Site Investigation (SI) activities that The Earth Technology Corporation (Earth Technology) performed at the 183rd Fighter Group (FG), Capital Airport, Illinois Air National Guard (ILANG), under the U.S. Department of Defense (DOD) Installation Restoration Program (IRP). The field activities were conducted from November 16 to December 8, 1992 and from April 12 to April 21, 1993. The SI activities were performed in accordance with the Work Plan (WP) (The Earth Technology Corporation, September 1992).

1.1 PURPOSE OF THE INSTALLATION RESTORATION PROGRAM

DOD has initiated the IRP to identify, evaluate, and remediate suspected environmental problems associated with past usage, storage, handling, and disposal of hazardous substances at DOD facilities. Section 120 of the Superfund Amendments and Reauthorization Act (SARA) of 1986 requires that IRP activities adhere to procedures specified in the National Contingency Plan (NCP) Final Rule [55 FR 8666]. The NCP details a sequence of steps to be followed when investigating and cleaning up suspected hazardous waste sites. This sequence begins with the discovery of a suspected hazardous waste release or threat of release, and ends with a permanent remedy to eliminate or minimize the environmental impact and long-term monitoring of the remediation effort. The five phases that constitute the IRP process and the purpose and activities associated with each phase are presented below:

- **Preliminary Assessment** – A Preliminary Assessment (PA) is performed to identify the location of suspected problems associated with past hazardous waste handling procedures, disposal sites, and spill sites. This is accomplished through interviews with past and present base employees, historical records searches, and visual site inspections. Detailed geologic, hydrogeologic, meteorologic, land use, and environmental data for the area of study are also gathered. A detailed analysis of all information obtained identifies sites of concern. The PA for ILANG, Capital Airport was begun by the Dynamac Corporation through the Hazardous Materials Technical Center (HMTC) and completed by Science and Technology (SCITEK) in May 1990.
- **Site Investigation** – The purpose of an SI is to acquire the necessary data to either confirm or deny the existence of contamination at each identified site of concern and to preliminarily evaluate the potential risks to human health, welfare, or the environment. The SI includes identifying specific chemical contaminants and their concentrations in environmental media and determining their potential for contaminant migration through site-specific hydrogeologic investigations. Earth Technology completed SI field activities for ILANG, Capital Airport between November 1992 and April 1993.
- **Remedial Investigation** – During a Remedial Investigation (RI), necessary data are acquired to define the extent of confirmed contamination and to further assess the associated potential risks to human health, welfare, or the environment. The RI quantifies the magnitude and extent of contamination at the sites under investigation and identifies the specific chemical contaminants present and their concentrations in environmental media. A determination also is made as to the potential for contaminant migration by assessing site-specific hydrogeologic and contaminant characteristics.

- **Feasibility Study** – A Feasibility Study (FS) is performed to develop the remedial action alternative that mitigates confirmed environmental contamination at each site and meets the applicable or relevant and appropriate requirements (ARARs). The FS considers risk assessments and cost benefits analyses in providing the necessary data, direction, and documented supportive rationale to acquire regulatory concurrence (federal, state, and local) with the recommended remedial alternative. During the FS, recommendations are evaluated, developed, and provided for remedial actions at each site where remediation is required.
- **Remedial Design** – The purpose of Remedial Design (RD) is to provide engineering design drawings and construction specifications required to implement the recommended remedial action selected through the FS process. Implementation of the remediation plan requires appropriate regulatory acceptance.

The IRP requires the identification and evaluation of environmentally deleterious sites on DOD installations and the control of adverse effects on human health or the environment from those sites. The Air National Guard Readiness Center (ANGRC), through a U.S. Air Force (USAF) interagency technical support agreement with the U.S. Department of Energy (DOE), uses Martin Marietta Energy Systems, Inc. (Energy Systems) to provide technical assistance for the implementation of the ANG IRP. Earth Technology has been retained by Energy Systems under the Hazardous Waste Remedial Actions Program (HAZWRAP) to conduct the IRP SI at ILANG, Capital Airport.

1.2 PURPOSE OF THE SITE INVESTIGATION

This SI was conducted to determine whether environmental contamination is present at ILANG, Capital Airport and to characterize the nature of any identified contamination. The presence of contaminants in the groundwater and soils at the sites was determined and the impacts and risks of confirmed contamination to the environment and surrounding populations were evaluated during the SI. Characterization of the sources and nature of the contamination, as well as a preliminary evaluation of the movement of confirmed contaminants at the sites and identification of possible receptors of potential contamination, also were included. Contaminated sites may require additional field investigative efforts (RIs) to characterize completely the magnitude and extent of any confirmed contamination. The SI at ILANG, Capital Airport was conducted to:

- Determine the chemical nature and magnitude of identified contaminants
- Evaluate the potential for contaminant release and migration
- Conduct a preliminary risk evaluation addressing ARARs for remediating confirmed contamination at each site
- Prepare recommendations for broader investigative activities (RIs) to determine the magnitude and extent of contamination, if necessary
- Evaluate the need for immediate response actions
- Support no further action decisions and the completion of Decision Documents (DD).

The objectives of the SI are to provide recommendations to:

- Continue characterizing those sites where contamination was confirmed by conducting an RI/FS
- Initiate a Focused Feasibility Study (FFS), where appropriate, to select a Remedial Measure (RM)
- Initiate immediate response actions
- Take no further action and complete DD.

1.3 REPORT ORGANIZATION

This SI report contains the following sections:

- **Section 1.0 Introduction** – The remainder of this section summarizes the history of the base; the specifics of each individual site; previous studies conducted at the base, and an overview of the demographics and regional geology and hydrogeology.
- **Section 2.0 Field Program** – This section describes the activities, methods, and procedures used for determining the presence or absence of environmental contamination and the hydrogeologic conditions at the base. This section addresses background sampling and the disposal of wastes generated during the SI field program. Variances between the proposed work plan activities and the actual field work are also discussed.
- **Section 3.0 Significance of Results** – This section provides the geologic, hydrogeologic, and chemical results obtained during the SI program along with the significance of the results. Local or base-specific background data are presented in this section.
- **Section 4.0 Preliminary Risk Evaluation (PRE)** – In this section, the sampling results are compared to the ARARs, and a preliminary qualitative human health and ecological risk evaluation is presented.
- **Section 5.0 Conclusions and Recommendations** – This section presents a site-by-site result summary, conclusions of the SI findings, and recommendations of the SI for any future IRP activities.

A reference list and a list of acronyms and abbreviations is included in this SI report. In addition, a separate appendix volume detailing monitoring well and soil boring completion, field forms, soil gas and groundwater screening surveys, surveying data, analytical results, aquifer test methods, and a detailed data quality discussion is provided.

1.4 BASE BACKGROUND

The history of ILANG, Capital Airport and a description of each of the sites that were investigated as part of this SI are presented in the following sections.

1.4.1 Base History

The base, consisting of approximately 97 acres, is located on the northeast portion of Springfield Airport Authority (SAA) property, northwest of Springfield, Illinois (Figure 1-1). The land around the base is residential and commercial with agricultural land to the south and northwest of the airport. The base was first used by the 170th Fighter Squadron of the ILANG in 1948. It was equipped with F-51 Mustang aircraft. In 1951 the unit was redesignated as the 170th Fighter Bomber Squadron. In 1953 the F-51 was phased out and replaced with the T-33 jet trainer and F-86 Sabre Jet. The F-84 Thunderstreak jet replaced the F-86 in 1955. In 1962 the unit designation was changed to the 170th TFG. This group was composed of four support units: the 170th TFG; the 183rd Dispensary; the 183rd Material Squadron; and the 183rd Combat Support Squadron. The F-4 Phantom was assigned to the unit in 1972, F-4C aircraft in 1975, the F-4D aircraft in 1981, and currently the F-16 aircraft. The ILANG is currently supported by the 183rd FG. (SCITEK, 1990).

1.4.2 Site Descriptions

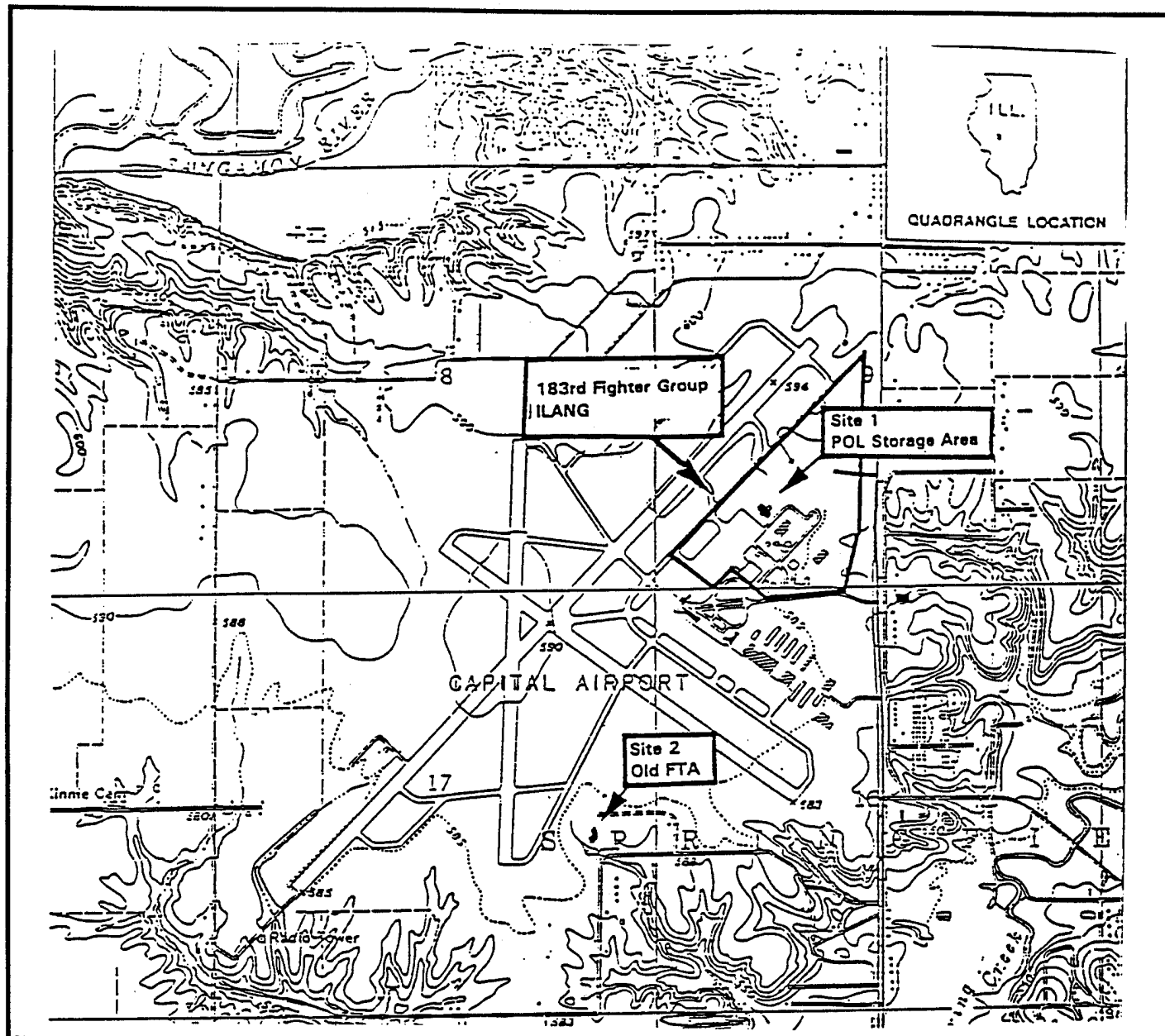
The PA was completed by SCITEK in 1990. Activities included a detailed review of pertinent installation records and an on-site base visit including interviews with past and present employees. At that time, two past disposal and/or spill sites were identified. These sites were further evaluated using the Air Force's Hazardous Assessment Rating Methodology (HARM). The two sites are listed below:

- Site 1: Petroleum, Oil, & Lubricant (POL) Storage Area
- Site 2: Old Fire Training Area

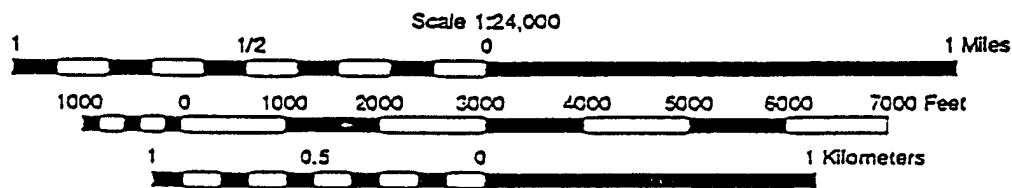
Descriptions of the sites investigated during this SI program are described below. The site locations are shown on Figure 1-1. The POL storage area is located on base property while the Old Fire Training Area (FTA) is off-base on SAA property. Individual site maps are presented as Figures 1-2 and 1-3.

1.4.2.1 Site 1 - POL Storage Area

The POL Storage Area, consisting of four 25,000 gallon Petroleum Jet Fuel #4 (JP-4) fuel underground storage tanks (USTs), is located on the northwest side of the base. A spill occurred at the POL storage area sometime between 1958 and 1959 when a fuel transfer pump leaked approximately 3,100 gallons of JP-4 onto the ground. The base fire department was called to clean up the spill, but very little fuel was recovered. The fuel was covered with foam and washed with water to a storm drain located across from the transfer pumps. The storm drain ultimately discharges into a tributary east of the base. It was reported that some fuel soaked into the ground surrounding the POL facility.



Source: USGS 7.5 minute Illinois quadrangles:
Springfield West (1965) Photorevised 1971 and 1976



Contour Interval 10 Feet
National Geodetic Vertical Datum of 1929



North

Explanation

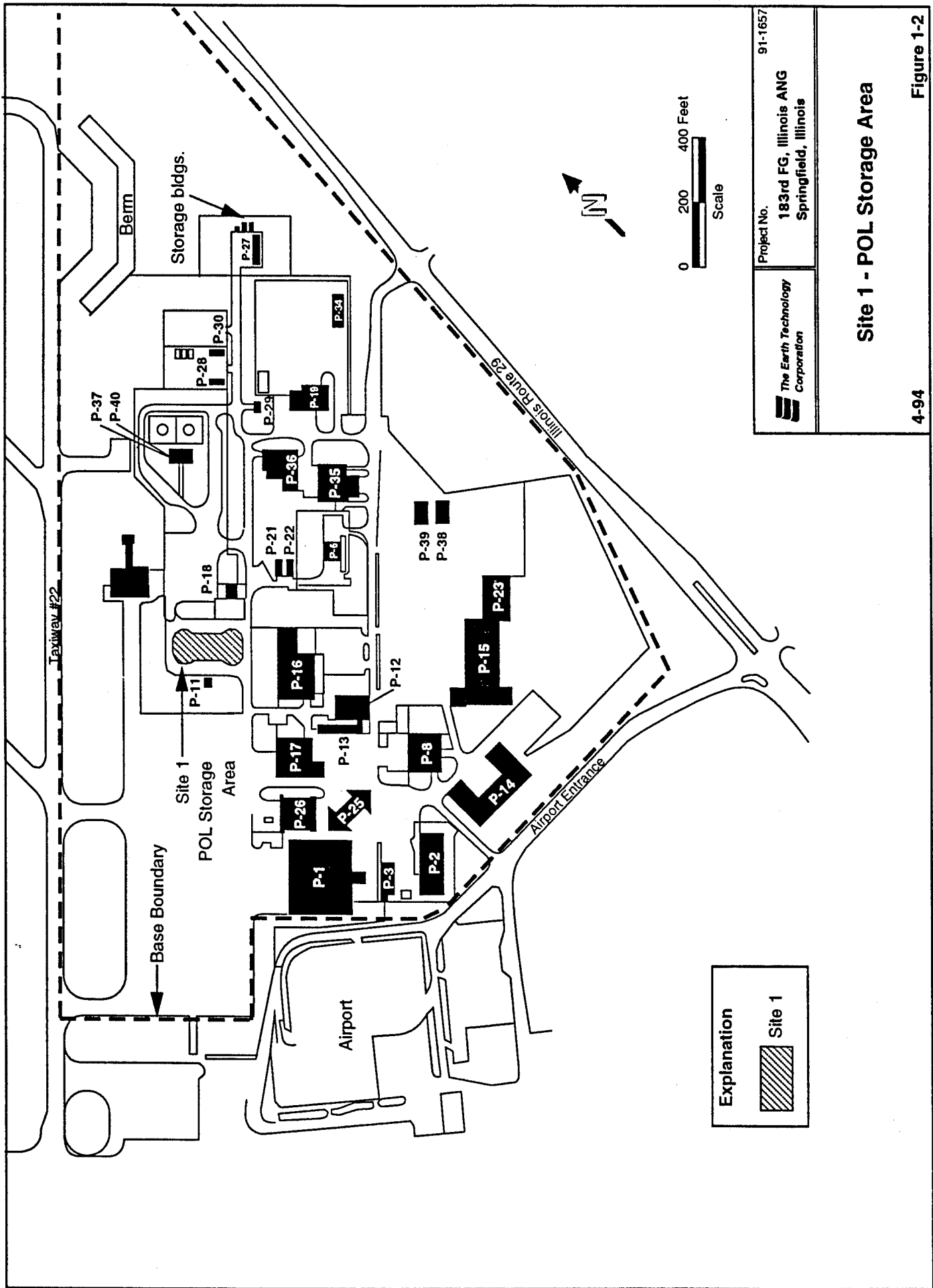
— 183rd FG boundary

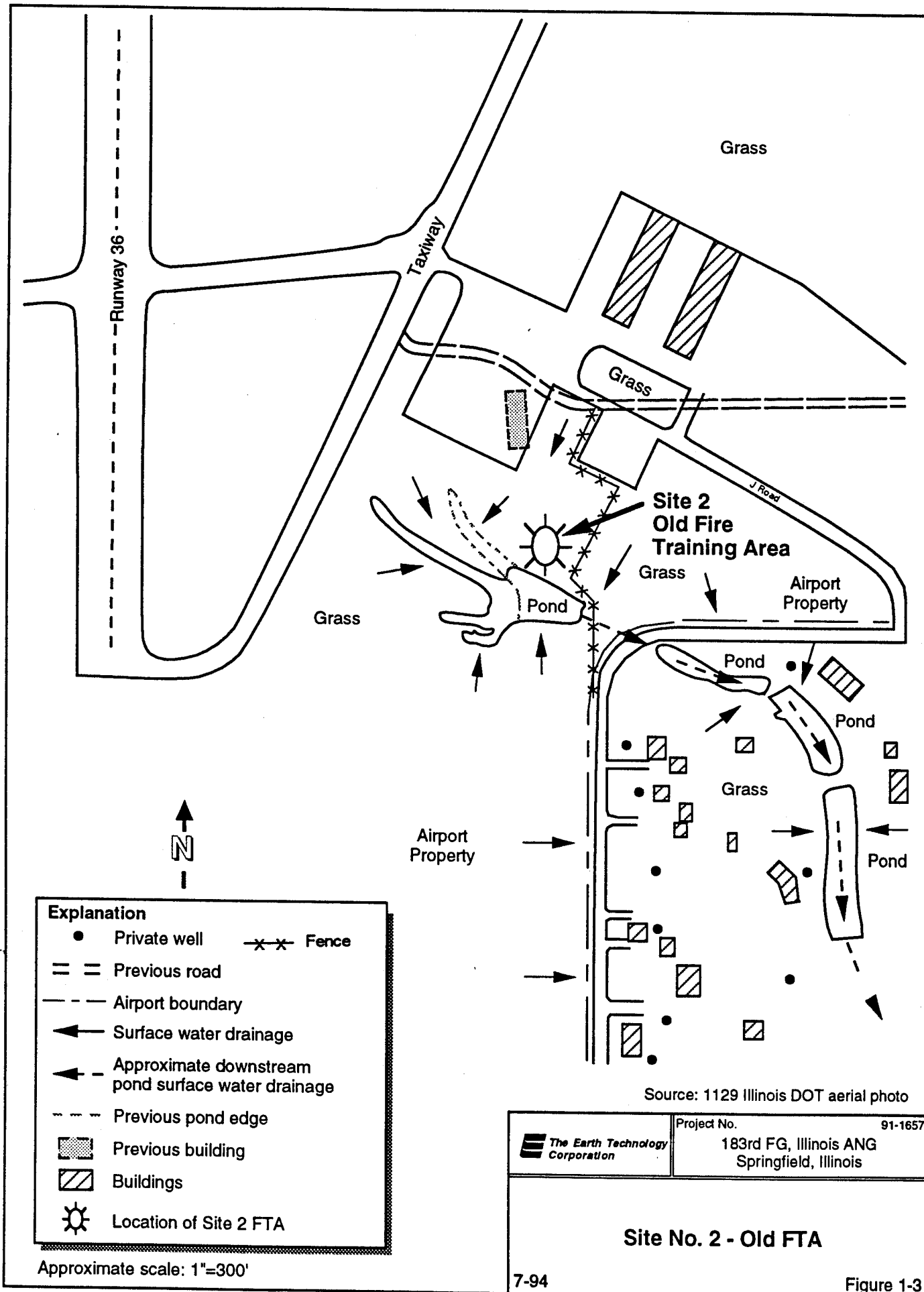
The Earth Technology Corporation®

Project No. 911657

183rd FG, Illinois ANG
Springfield, Illinois

**Location of the 183rd FG
and Sites 1 and 2**





Minor fuel spills were reported before 1981 in the POL area. Three spills were from truck overfills and from operations during unloading delivery trucks. These spills were washed down to the grass or rocky area away from the drains.

1.4.2.2 Site 2 - Old Fire Training Area

The FTA is located off-base on SAA property east of the approach end of Runway 36 and approximately 120 ft north of a small pond and intermittent stream on the south side of the airport. There is no visible evidence of the FTA. Part of the area is grassed over and part is now a concrete parking apron. According to 1975 and 1989 base aerial photographs, the old FTA appears to be in the grassed area. A pond which collects surface runoff was located near the FTA and is still in existence, although photographs indicate its location is somewhat different due to excavation in the area.

The FTA was utilized for fire training operations approximately twice a month from 1949 to 1974 by base and SAA personnel. Flammable liquids were burned that may have included any of the following: JP-2, JP-3, and JP-4 fuel, paints, paint strippers, solvents, and other flammables from various shops.

1.5 PREVIOUS PROGRAM ACTIVITIES

A PA was begun by the Dynamac Corporation through HMTC and completed by SCITEK through HAZWRAP. The final PA report was completed by SCITEK in May 1990 and recommended that further IRP action be implemented at two sites at the base. These two sites were identified using the USAF HARM. The purpose of this model is to assign a ranking to each site where there is suspected contamination from hazardous substances to the surrounding population and other receptors in the environment. This rating system is only used for sites where the potential for contamination (hazardous waste present in sufficient quantities) and contaminant migration exists.

The model used data obtained during the site visit portions of the PA, and information obtained from base records, interviews with past and present base personnel, and published reports. The final score is a combination of scores in the following three categories: receptors, waste characteristics, and pathways. Table 1-1 tabulates both the overall and category-by-category scores for each of the two sites initially identified in the PA (SCITEK, 1990).

**Table 1-1 Site Hazard Assessment Scores
ILANG, 183rd Fighter Group, Capital Airport, Springfield, Illinois**

Site No	Site Description	Receptors	Waste Characteristic	Pathway	Waste Management Practices	Overall Score
1	POL Storage Area	55	80	80	0.95	68
2	Old FTA	48	100	80	1.0	76

In February 1991, a soil organic vapor (SOV) survey was completed at the POL storage area by Patrick Engineering, Inc. Soil vapor samples were collected and were analyzed for benzene, toluene, ethylbenzene, and xylenes (BTEX) and total petroleum hydrocarbons (TPH). Based on the

investigation it was concluded that JP-4 contamination of soil and groundwater is probable. Collection of soil and groundwater samples was recommended.

1.6 REGIONAL GEOLOGIC SETTING

The base is located on the northeast portion of the SAA property approximately 2 miles northwest of Springfield, Illinois. The base and the airport are situated on a mature dissected plateau located approximately one mile south of the Sangamon River (Figure 1-1). Bordering the south edge of the plateau is Spring Creek, a tributary of the Sangamon River. Maximum relief on the plateau is 15 ft. The base is not within the 100-year floodplain of the Sangamon River or Spring Creek. Both the Sangamon River and Spring Creek are entrenched and bordered by a 20 to 50 ft escarpment.

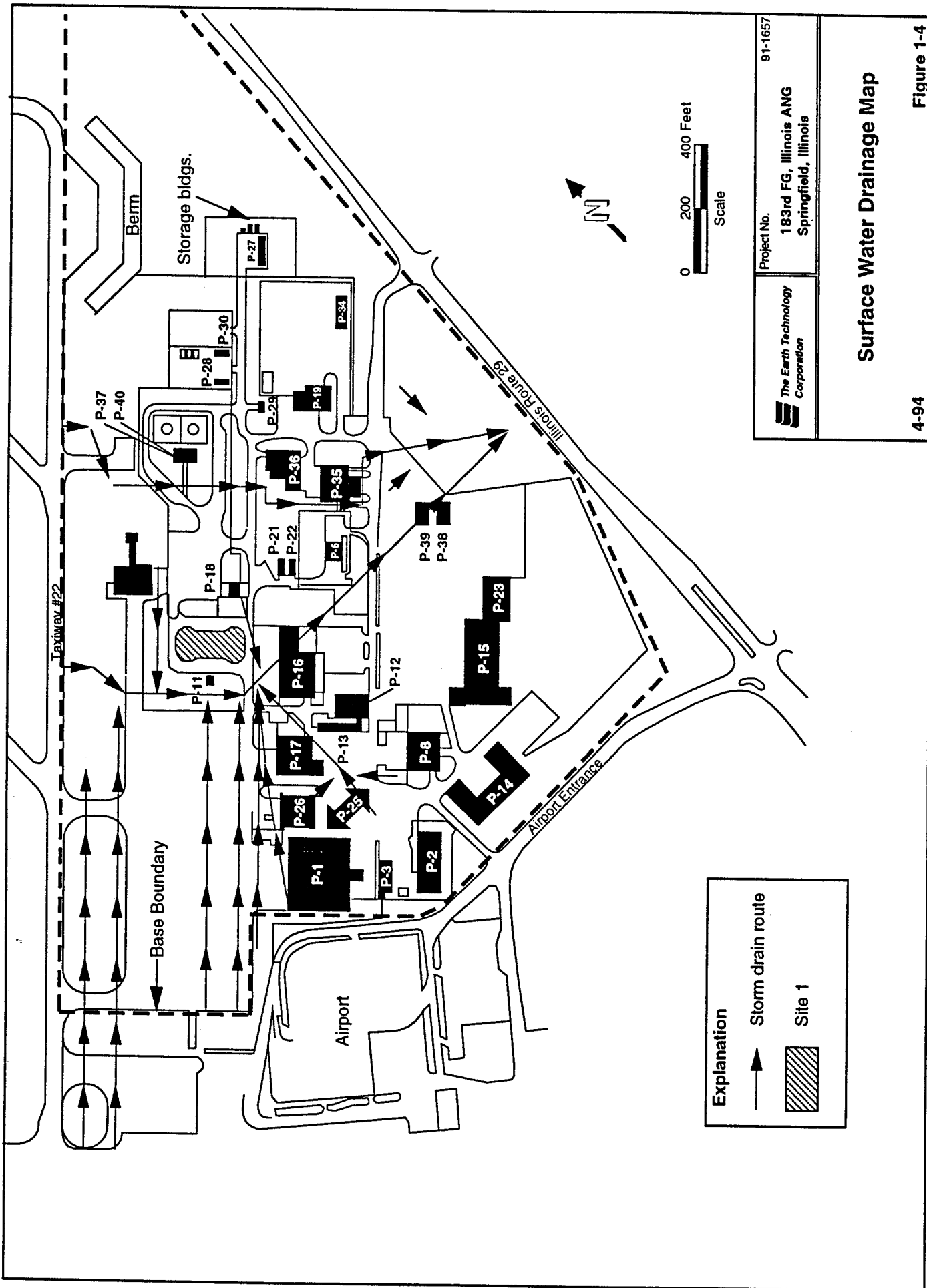
Surface water drainage routes for the two sites under investigation are represented in Figures 1-3 and 1-4. Surface water drains by open ditches or overland to the pond located at Site 2. The pond drains through a steel pipe to the southeast towards County Road 125 West. Surface runoff at the base (Site 1) is collected in a series of storm drains, open ditches, and drainage swales. This runoff joins the airport's storm drain system and the outfall flows into an unnamed tributary of Spring Creek. Spring Creek flows into the Sangamon River.

The soil types at the base are Hartsburg silty clay loam, Ipava silt loam, Sable silty clay loam, Keomah silt loam, and Fayette silt loam. Permeability (infiltration) for each of these soils is moderate, ranging from 4.45×10^{-4} cm/sec to 1.14×10^{-3} cm/sec.

The climate of Springfield, Illinois is temperate in both temperature and precipitation. Table 1-2 displays the climate statistics for this area.

Physiographically, the base is located within the Illinois Basin, west of the La Salle Anticlinal Belt and East of the Athens Valley Fill (Bergstrom, et al, 1976). The La Salle Anticlinal Belt is a north to south trending upward fold in bedrock due to orogenic movement in the earth's crust. This upward fold created basins to the east and west. The western basin has been termed the Illinois Basin. Athens Valley is an ancient valley caused by glaciation and glacial runoff. The valley is now filled with Pleistocene-aged deposits similar to the rest of the Illinois Basin.

The plateau on which the base is situated is structurally simple. Pleistocene glacial drift, loess, and alluvium blanket the Pennsylvanian McLeansboro Group sedimentary bedrock (Figure 1-5). According to Bergstrom, et al, 1976, the McLeansboro Group is composed of the Mattoon, Bond, and Modesto Formations (Fm).



Time-stratigraphic units		Rock-stratigraphic units			Average thickness of formation (ft)	Description
System	Series	Group	Formation	Selected members		
Pennsylvanian	Missourian	McLeansboro	Mattoon		100+	Shales, siltstones, sandstones, and thin limestones, claystones, and coals
			Bond	Millersville Limestone	200	
				Shoal Creek Limestone		
	Desmoinesian	Modesto	Chapel (No. 8) Coal	250		
			Trivoli Sandstone			
			Lonsdale Limestone			
		Kewanee	Carbondale	Danville (No. 7) Coal	225	
				Brereton Limestone		
				Herrin (No. 6) Coal		
				St. David Limestone		
				Springfield (No. 5) Coal		
				Summum (No. 4) Coal		
				Colchester (No. 2) Coal		
	Spoon	Litchfield Coal	150			
Atokan	McCormick	Abbott		150		

Source: Bergstrom et al, 1976


	Project No. 911657
	183rd FG, Illinois ANG Springfield, Illinois
Generalized Stratigraphic Section of Illinois	
4-94	Figure 1-5

Table 1-2 Springfield Climate Statistics

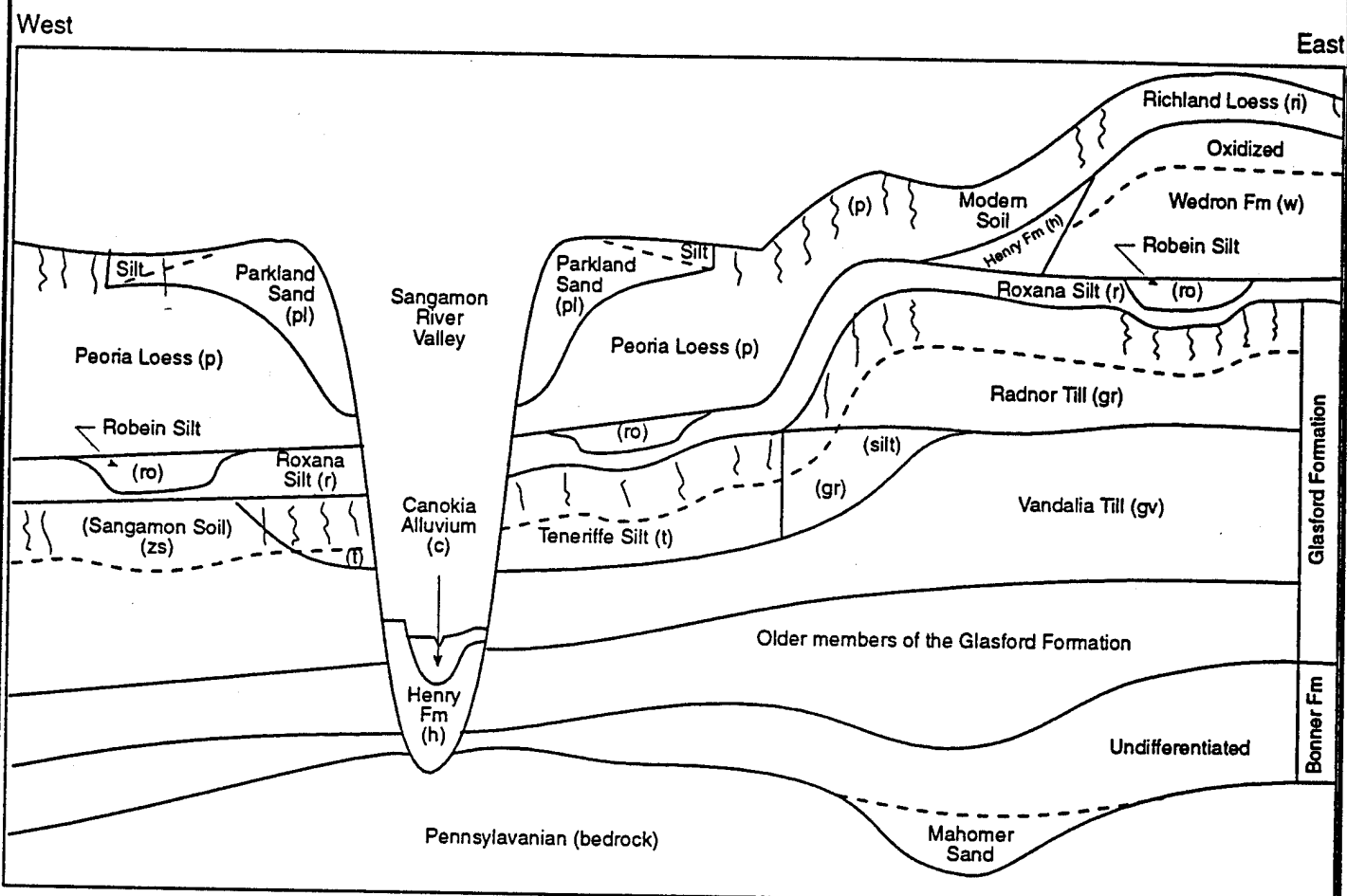
Average Temperature		
Monthly		
Maximum	Minimum	Annual
75° (July) ¹	30°F (December) ¹	54°F ¹
Frost Season (Average):		19 October to 17 April ²
Average Annual Precipitation:		52.67 ¹
Annual Snow Fall:		11.7 (1990) ¹
Average Annual Wind Speed:		10.6 mile per hour ¹
Average Number of Days with >0.01" of precipitation		119 days ¹
Average 1 year 24 hour rainfall event		2.75" ²

Note: 1 National Oceanic Atmospheric Administration (NOAA), 1990
 2 Koss, Owenby, Steuer & Ezell, 1988

Based on unpublished well logs on file at the Illinois State Geological survey in Champaign, Illinois, the alluvium and loess deposits are 5 to 30 ft thick over what local drillers report as a blue shale. All 24 records reviewed exhibit a blue clay or shale at or near the bottom of each hole. This may be the remnants of the Mattoon Fm. The presence of a clay or shale below unconsolidated soils provides a potential barrier for vertical migration of contaminants. All the wells are completed above the clay in alluvium and loess deposits. Deeper sources of water may be available but no records are available to prove this. The Pennsylvanian McLeansboro Group is expected to be of poor water quality due to the presence of coal and pyritic shales associated with the coal. The alluvium and loess deposits are described but not mapped in this area. Figure 1-6 shows the wide variety of unconsolidated Pleistocene deposits on the Plateau near the Sangamon River. The Glasford Fm comprises the largest percentage of blanketed materials above Pennsylvanian bedrock. A single borehole, completed in 1912 by Peabody Coal Company along the Sangamon River, reported clay/shale bedrock at 46 ft below ground surface (bgs). Further examination of this log reveals the respective members of the Bond Fm and Modesto Fm down to 260 ft bgs.


Although the elevation and exact location of these unpublished well and boring logs are not field checked, a few observations are distinct in the data. The surface of the bedrock is an average of 24 ft deep with a standard deviation of 7.6 ft. This data set exhibits a normal distribution with a coefficient of variance of 31.1%. The coefficient of variance basically describes the variability between data points. The maximum and minimum observations were 46 and 11 ft, respectively.

Groundwater in Sangamon County is described by Selkregg and Kempton, 1958. Pleistocene deposits of sands, gravel, and loess comprise the chief aquifer in this region. Wells tapping this source usually require screens and careful development. The next potential water bearing zones are deeper within the Pennsylvanian McLeansboro Group. The McLeansboro water flow and chemistry is highly variable. Water quality generally decreases with depth because of the increasing presence of coal and pyritic shale. Water bearing zones below the coal measures are believed to be too deep to be considered a source of groundwater. Local well records from the Illinois Geological Survey have been consulted, but in general only locate the well to the nearest 40 acres. However, off-site groundwater wells used for residential or domestic purposes are present southeast of Site 2, across County Road 125 West (Figure 1-3). These wells were abandoned in the spring of 1994. This water well data exhibits well depths ranging from 30 to 60 ft completed just above the McLeansboro. Head elevations of the water table are not given in these records. According to the PA (SCITEK, 1990), construction borings on base encountered water from 1 to 15 ft bgs. No data



Source: Bergstrom et al, 1976

Not to Scale

	Project No. 911657 183rd FG, Illinois ANG Springfield, Illinois
<p align="center">Generalized Cross Section of the Unconsolidated Sediments at the Base and Vicinity</p>	
4-94	Figure 1-6

is available to indicate the presence or absence of a clay or loess that may perch water within these Pleistocene deposits.

According to the Illinois Department of Conservation, Department of Natural Heritage, there are no endangered or threatened species within a 1-mile radius of the base. Furthermore, no designated critical habitats occur within this area (Kruse, 1988). Information from the United States Fish and Wildlife Service in Illinois confirms this information (personal communication with Mr. Gerry Bade, U.S. Fish and Wildlife Service, Illinois, October 11, 1989).

2.0 FIELD PROGRAM

2.1 FIELD PROGRAM SUMMARY

The SI field program activities that Earth Technology implemented at ILANG, Capital Airport during 1992 and 1993 are described in this section. These activities included soil gas sampling; drilling soil borings; installing monitoring wells; soil, sediment, surface water and groundwater sampling; and aquifer testing. Sections 2.2 through 2.6 describe the methods, procedures, and purpose for performing these activities. The field program is summarized in Table 2-1.

**Table 2-1 Summary of Site Investigation Field Program
183rd FG, ILANG, Springfield, Illinois**

Screening Activity	Site 1	Site 2	Facility	Total
Soil Gas Samples (screening)	0	28	0	28
Soil Samples (screening)	8	14	0	22
Groundwater Samples (screening)	1	16	0	17
Totals (screening)	9	58	0	67
Borings	13	13	3	29
Soil Borings	5	7	3	15
Piezometer Installation	4	3	0	7
Monitoring Well Installation	4	3	0	7
Aquifer Slug Tests	3	2	0	5
Analytical Samples^(a)				
Soil Samples from Soil Borings - Field Gas Chromatograph	30	28	0	58
Soil Samples from Soil Borings - Laboratory Analysis	17 ^(b)	17 ^(c)	6	40
Geotechnical	1 ^(d)	1 ^(d)	0	2
Sediment - Laboratory Analysis	0	3 ^(c)	0	3
Groundwater - Laboratory Analysis ^e	8 ^(b)	6 ^(c)	0	14
Surface Water - Laboratory Analysis	0	3 ^(c)	0	3 ^(a)

(a) Duplicates not included

(b) Volatile Organic Compounds (VOCs), Semivolatile Organic Compounds (SVOCs), Lead

(c) VOC, SVOC, Polychlorinated Biphenyl (PCB)\Pesticides, Target Analyte List (TAL) Metals

(d) Grain size, Capillary moisture, Clay mineralogy, Atterberg limits, Specific gravity, Hydraulic conductivity, Moisture content/Density, Cation exchange capacity

(e) Includes two rounds of sampling

All changes to the field activities as outlined in the workplan were minor. These changes are documented in Appendix A, Field Change Requests.

2.2 GEOLOGIC AND HYDROGEOLOGIC INVESTIGATIONS

A number of techniques were used at ILANG, Capital Airport to provide geologic and hydrogeologic data. Subsurface drilling of soil borings and monitoring wells provided geologic information about

the base and the sites; hydrogeologic data were obtained through static groundwater elevation measurements and aquifer slug testing. These activities and the procedures used are described below.

2.2.1 Static Groundwater Measurements

Groundwater elevation measurements were collected at ILANG, Capital Airport to estimate groundwater flow directions and to help estimate groundwater flow rates. Measurements were taken following piezometer installation to establish a general basic flow direction and to enable strategic placement of monitoring wells. During the monitoring well installation phase, water level readings were taken to ensure the integrity of the wells and piezometers. A final round of water level measurements was taken after groundwater sampling had occurred to establish an accurate water table contour map.

The groundwater level measurements were recorded at each piezometer and monitoring well with an electric water level indicator. A surveyed notch on the top of the casings in the monitoring wells and the piezometers served as the reference point. Measurements were recorded to the nearest 0.01 ft. These data are presented in Appendix B.

2.2.2 Aquifer Testing

Both rising head (slug-out) and falling head (slug-in) aquifer tests were performed in April 1993. Five of the seven monitoring wells installed during the fall of 1992 were slug tested. The five wells (three from Site 1, and two from Site 2) were selected to provide sufficient aquifer test data per site. These tests were short-duration, single-well tests conducted by displacing the water level in a well and then recording the water level response in the well as it recovered to static conditions. This testing is conducted to determine the hydraulic conductivity of the natural formations and materials in the localized area surrounding the well. Extended periods of rain occurred during the April 1993 field event. This created rising water levels in the unconfined aquifer. Because of the rising water table conditions, both slug-in (falling head) and slug-out (rising-head) tests were conducted in each well. The hydraulic conductivities calculated for each well were averaged to compensate for the changing hydraulic conditions.

The water levels were displaced by using a 3-ft long, 1.66-in. outside diameter (OD) solid stainless steel bailer. The bailer was used to lower or raise the water level in the well, and the static water level allowed to return to equilibrium. A Terra-Systems Model SCCE-036 Data Logger was the recording device used to collect the data from each well. Water levels were measured at selected time intervals translated from a pressure transducer set in the well.

Before the start of each test, the date, internal clock, test number, sampling rate (timed intervals), and initial static recorder reading were checked and adjusted, if necessary. After approximately 20 minutes, the data were reviewed, and the tests stopped after the water level had recovered to at least 95% of the initial drawdown. The data were reviewed in the field to ensure data quality.

The data collected during the aquifer tests were analyzed using an aquifer test solving computer program, AQTESOLV™, designed by Geraghty & Miller, Inc. (1991). AQTESOLV™ uses analytical solutions developed by Bouwer and Rice (1976). In turn, transmissivities and Darcy flow velocities were calculated. Site-specific results are discussed in Section 3. Aquifer test field data and time-drawdown curves are also provided in Appendix B.

2.2.3 Geotechnical Analyses

Two vadose zone soil samples, one each from Site 1 and Site 2, were collected for geotechnical analyses. Soil samples were collected by driving a 3-ft long, 3-in. inner diameter (ID) Shelby tube sampler into the soil. The tubes were sealed at each end with wax, covered with teflon caps, and taped to preserve soil moisture content. The Shelby tube was submitted for laboratory analysis of the following parameters:

- Grain size
- Capillary moisture
- Clay mineralogy
- Atterberg limits
- Specific gravity
- Hydraulic conductivity
- Moisture content/density
- Cation exchange capacity

The results of the geotechnical sampling are presented in Appendix C.

2.2.4 Piezometer Installation

Seven piezometers (PZ101 through PZ104 and PZ201 through PZ203) were installed into the surficial aquifer during the December 1992 drilling program. PZ104 was installed on the northwest corner of the tank pit at Site 1 to determine if free phase JP-4 was present floating on the groundwater at this location. Soil samples were collected from each piezometer boring and screened using the on-site gas chromatograph (GC). Detailed lithologic and construction logs are included in Appendix C.

The piezometers were constructed of 2-in. diameter, flush-joint, threaded, Schedule 40 polyvinyl chloride (PVC) screen and riser pipe. Slot size for the piezometer screens was 0.010 in. 5-ft long screen sections were selected for all piezometers with the exception of PZ104 where a 10-ft long section of screen was selected. The screened intervals were selected based on depth to the water table and the anticipated extent of the seasonal water table fluctuations.

Piezometers were backfilled using 20/40 grade Colorado silica sand to a depth approximately 1 foot above the top of the screen. A one to two foot layer of pelletized bentonite was placed on top of the sand pack and hydrated. The remaining annular space was filled with a cement/bentonite mixture. An expandable cap was placed on top of the casing and locked. All locks placed on the piezometers were keyed alike. The piezometers were finished by installing flushmount, 9-in. diameter steel drive over boxes on top of the piezometers. The drive boxes were cemented in place and finished with 2- x 2-ft concrete pads. The piezometers were labelled by placing brass survey markers in the concrete pad.

2.3 FIELD SCREENING SAMPLING AND ANALYSIS

Field screening activities consisted of initial site screening (on-site GC) analysis of soil-gas and grab-type groundwater and soil samples, and the on-site GC analysis of soil samples collected from the confirmation-round borings. Target compounds during each type of screening activities included BTEX, total volatile organic compounds (TVOCs) and several of the more common chlorinated aliphatic compounds (i.e. trichloroethene (TCE)).

2.3.1 Initial Site Screening Activities

During November 1992 Burlington Environmental Inc. was subcontracted by Earth Technology to conduct initial characterization of the extent of TVOCs at Site 2. No soil gas points were installed at Site 1. This initial phase of fieldwork was conducted to assist in the placement of the confirmation round soil borings and the monitoring wells. These activities consisted of the collection and analysis of soil gas and grab-type groundwater and soil samples.

Once collected, the soil gas samples were injected directly into the GC, while the soil and groundwater samples were sealed and allowed to equilibrate with air (headspace) inside 40-ml volatile organic compound (VOC) vials. A volume of headspace was removed from the vial and directly injected into the GC for VOC analysis. HAZWRAP Level B quality control (QC) protocols were followed during the on-site GC analysis of these samples. The SI workplan called only for the collection of soil gas and groundwater samples. However, some soils on base contained high clay contents which diminished the effectiveness of the soil gas method. As a substitute for many of the proposed soil gas samples, grab-type soil samples were collected at Site 1 and at portions of Site 2.

2.3.1.1 Sampling Methods - Initial Site Screening

In general, all sampling conducted during the initial field event was done using a truck-mounted hydraulic unit (Geoprobe™) capable of driving 3-ft long sections of hollow, threaded, 1-in. diameter stainless steel rods into the soil. Modifications of the hardware attached to the probes allowed the collection of either soil gas, grab-type groundwater, or grab-type soil samples. The specific methods used to collect each medium are discussed below.

Soil Gas Sampling

Twenty-eight soil gas samples from Site 2 were collected and analyzed in the field. Soil gas samples were initially taken in a fixed grid pattern. Soil gas sample locations are discussed in Section 3.7.2.1. As the on-site mobile laboratory results became available, subsequent sampling locations were modified based on these results.

As stated previously, a hydraulic probe-driving unit was used to drive and withdraw the soil-gas sampling probes. Soil-gas samples were collected by driving the probes 2 to 10 ft into the ground. A section of inert polyethylene tubing attached to a threaded adapter was inserted through the probe rods and threaded into the base of the lead probe rod. The aboveground end of the tubing was attached to one end of a gas collection bulb fitted with Teflon stop-cocks. A separate piece of tubing was connected between the opposite end of the bulb and a vacuum/volume sampling pump. One to four liters of air, depending on sample depth, was evacuated from the sample train using the vacuum pump. The sample was then collected in the bulb and both stopcocks closed simultaneously. The samples were analyzed by the methods described in Section 2.3.2.

Groundwater Sampling

Seventeen groundwater screening samples were collected at Sites 1 and 2 and analyzed using an on-site GC. As stated previously, a hydraulic probe-driving unit was used to collect the samples. After the probe had intercepted the groundwater, a section of inert polyethylene tubing was inserted through the probe rods into the groundwater. The aboveground end of the tubing was connected to a vacuum pump. A controlled vacuum was pulled until the water reached the ground surface.

The pump was then turned off, the tubing disconnected from the pump, and the water in the tubing was drained into a 40 ml glass vial sealed with a Teflon-lined septum screw-cap.

Soil Sampling

Twenty-two soil samples were collected from Sites 1 and 2 in locations where the soil was too compacted to collect soil gas. All samples were analyzed using the on-site GC. As stated previously, a hydraulic probe-driving unit was used to collect the soil samples. A soil sampling barrel was placed in front of the lead probe. The soil sampler was driven to the desired initial sampling depth. Inner extension rods were inserted into the probe rods and threaded into a retractable drive-point piston stop and the stop removed. The piston-stop prevents the retractable drive-point from being pushed up into the sample sleeve prior to reaching the selected sampling depth. The soil sampler assembly was then advanced 2 ft, pushing soil into the alloy steel sample barrel. The barrel was lined with a single-use acetate liner. Soil samples were collected at depths ranging from 2 to 11 ft. The probe rods and soil sampler were removed from the probehole and disassembled, and decontaminated. The soil sample was extruded from the sample barrel, placed in a 40-ml sample vial, sealed with a Teflon-lined septum screw-cap, and given to the GC technician for on-site analysis.

2.3.1.2 Analytical Methods - Initial Site Screening

The soil gas and grab-type soil and groundwater samples collected during the initial site screening activities were all analyzed for the same target compounds, using the same instrumentation, and using similar methods (direct injection of soil gas or headspace). This section provides a general description of the analytical instrumentation and target compounds for the headspace method, as well as a summary of analytical methods specific to the soil gas, soil, and groundwater samples. All analytical results are included in Appendix D.

Instrumentation and Target Compounds

A Hewlett-Packard Model 5890A Series II GC was used for the analysis of the analytical samples. Compound separation and detection were performed using a 30-meter wide-bore DB-624 capillary column and a flame-ionization detector (FID). The analysis was performed with an oven temperature profile of 45°C to a 95°C with a total analysis time of 10 minutes.

For this survey, the target compounds and their Lower Quantifiable Limits (LQLs) were as follows:

Compound	LQL ($\mu\text{g/L}$)
1,1-Dichloroethene (-DCE)	3
total 1,2-DCE	4
1,1,1-Trichloroethane (TCA)	4
Benzene	1
TCE	4
Toluene	2
Tetrachloroethene (PCE)	6
Ethylbenzene	2
Total Xylenes	2
Total Volatile Organic Compounds	2

Sample component concentrations were measured based on a three-point external standard calibration. Known concentrations of 1,1-DCE, 1,2-DCE, TCA, benzene, TCE, toluene, PCE, ethylbenzene, m-xylene, and o-xylene were prepared as gas-phase standards from appropriate methanolic solutions at levels of 10, 100, and 1,000 $\mu\text{g/L}$. Compounds peak area versus standard concentration was used to calculate sample concentrations. The computing integrator performed the calculation but occasionally a peak was mislabeled and the calculation was then performed by hand.

Compound identification was based on comparison of target compound retention times with sample retention times. A reference peak compound, a,a,a-trifluorotoluene, was added to each sample to aid in target compound identification. Compounds are considered as tentatively identified. Sample matrices and coeluting compounds can make peak recognition and identification difficult, in particular when the reference peak coelutes with sample retention times.

The LQL (as listed on the table above) is the lowest concentration of a compound that can be practicably measured relative to the calibration standard. Quantifiable limits are a function of the injection volume, and the detector sensitivity. The LQL is calculated from the current response factor, sample size, and the estimated peak area that would have been detected under the given conditions.

TVOC concentrations were calculated for each sample by summing all detected peaks, from the first calibrated compound to the last calibrated compound, subtracting the area of the reference peak compound, and relating the value to the toluene response factor.

Soil Gas Analysis

An aliquot of 10 to 500 microliters of the soil-gas sample was collected by inserting a syringe through the septa of the gas sampling bulb and drawing the sample into the syringe. The soil gas is then directly injected into the GC and analyzed. Appendix D contains the soil-gas analytical results.

Groundwater Analysis

Groundwater samples were prepared and analyzed according to modified U.S. Environmental Protection Agency (EPA) SW-846 Methods 3810 (static headspace screening) and 8010/8020 (EPA 1986). A 20-ml aliquot of 10 to 500 microliters of the headspace was collected by inserting a syringe through the septum of the vial and pulling the headspace sample into the syringe. The sample was then injected directly into the GC. Appendix D contains the groundwater analytical results.

Soil Analysis

The soil samples collected were analyzed for the target compounds listed in the soil-gas analysis section. These samples were prepared and analyzed according to modified EPA SW-846 Methods 3810 (Static headspace screening) and 8010/8020 (EPA 1986). Ten grams of soil were placed in a headspace sample vial. The soil was heated for 10 minutes at 70°C to equilibrate the volatile components between the soil and the air in the vial. An aliquot of 10 to 500 microliters of the headspace was collected by inserting a syringe through the septum of the vial and drawing the headspace sample into the syringe. The sample was then injected directly into the GC. Appendix D contains the soil screening analytical results.

2.3.2 On-Site GC Screening of Soil Samples

Soil samples were collected from the confirmation-round soil borings and analyzed on-site for their VOC content. These data were collected to assist the field team in selecting the soil samples to be shipped for analysis in a fixed-base laboratory. The on-site screening of the soil samples was completed following HAZWRAP Level B QC protocols. A description of the sampling and analytical methods is described in the following sections.

Soils were collected from the split-spoon samples and placed in a pre-cleaned, 40 ml VOC vial. The vials were filled to approximately two thirds to three-quarters of their capacity, capped, labeled, and hand delivered to the GC analyst. Upon delivery, the GC analyst filled the vials with deionized water until they were three-quarters full. The soil/water mixture was shaken vigorously for two minutes, placed in a water bath, and warmed to 40°C. The headspace in the VOC vial was withdrawn through the Teflon® septum using a syringe and injected into the portable GC.

Analysis was conducted using a Photovac 105 Plus GC equipped with a 10 meter capillary column and Photo-Ionization Detector (PID). The analytical methods used for headspace analysis during the screening were based on EPA SW-846 Method 3810 (EPA 1986).

All samples collected for field GC analysis were analyzed for the compounds listed below. The estimated Method Detection Limits (MDL) are also listed below:

Compound	MDL (ppb)
Benzene	1
Toluene	4
Ethylbenzene	4
o-Xylene	4
m, p-Xylene	4
TCE	1
PCE	1
DCE	1

Quality assurance (QA)/QC procedures included a daily three-point calibration and the analysis of blank and duplicate samples. The analytical results are included in Appendix E.

2.4 DECONTAMINATION PROCEDURES

Major equipment such as the drill rig, augers, and rods were decontaminated prior to beginning work at the base. Decontamination consisted of washing the equipment with high pressure hot water containing a laboratory grade detergent (Liquinox) and rinsing the equipment with water. Wastewater generated during the decontamination process was collected in large polyethylene tanks. All wastewater generated during the decontamination procedures was containerized and disposed of as described in Section 2.8.

Downhole drilling equipment such as augers, bits and rods were decontaminated as described above prior to each use. The drill rig was cleaned between sites, and at the discretion of the field team leader. Sampling equipment, such as split spoons, bailers, stainless steel liners, etc were decontaminated as follows:

- Washed with potable water/laboratory grade detergent (Liquinox)
- Rinsed with potable water
- Rinsed with pesticide-grade methanol
- Rinsed with American Society for Testing Materials (ASTM) Type II water
- Air dry
- Wrapped in aluminum foil.

The hydraulic unit, rods and sampling equipment used to collect the soil gas samples were decontaminated by washing the probes and other sampling equipment in a water/laboratory grade detergent and rinsed with water.

2.5 SAMPLING FOR FIXED-BASE LABORATORY ANALYSIS

The SI conducted at Sites 1 and 2 was based primarily on the collection and fixed-base laboratory analysis of selected soil and groundwater samples. The term "fixed-base" denotes a full service, non-field laboratory, typically located off-site in a permanent, climate-controlled building. Two fixed-base laboratories were utilized for analysis of SI soil and groundwater samples: Pace Incorporated of Wappinger Falls, New York, and CompuChem Laboratory, Incorporated of Chapel Hill, North Carolina. Laboratory analyses included the following: VOCs in soil according to EPA SW-846 Method 8240 (EPA 1986); VOCs in groundwater according to EPA SW-846 Methods 8010 and 8020 (EPA 1986); semivolatile organic compounds (SVOCs), including pesticides and polychlorinated biphenyls (PCBs), in soil and groundwater according to EPA Contract Laboratory Program (CLP) March 1990 methods (EPA 1990); and Target Analyte List (TAL) metals in soil and groundwater according to EPA CLP February 1988 methods (EPA 1988). Sampling and analyses were conducted according to HAZWRAP QC Level C guidelines. QA/QC evaluation and fixed-base laboratory data and validation summaries are presented in Appendix F and G, respectively.

Established sample chain-of-custody (COC) procedures were followed during fixed-base sampling activities. Field data sheets, COC records, and analytical request forms were completed by the appropriate sampling and laboratory personnel for each sample. Custody seals were used to seal the coolers when samples were shipped to the laboratory to ensure that no sample violations

occurred during transportation. HAZWRAP specifications for shipping and packing requirements (DOE/HWP-69/R1) were followed.

2.5.1 Soil Sampling Activities

Soil sampling was conducted using either a truck-mounted drill rig or a hand auger. Procedures for both types of sampling are described below.

2.5.1.1 Soil Sampling (Drill Rig)

Soil samples were collected from soil borings drilled at Sites 1 and 2. All borings were advanced with a truck-mounted drilling rig (CME75) using continuous-flight hollow-stem augers. Samples were collected at selected intervals from these borings using 3-in. diameter, 2-ft long stainless steel split spoons. The inside of the split spoon contained 6-in. long stainless steel liners. The drill rig was used to push the lined split spoons through to the hollow-stem augers into the soil. Once filled, the split spoons were retrieved and opened. Immediately upon opening the split spoon the liners were split apart either by hand or by using a decontaminated stainless steel knife. The end of each liner was scanned with a PID meter and the reading recorded. Based on the PID readings, the liner with the highest reading was selected for laboratory analysis. In areas with high concentrations of contaminants, the liners with the highest GC results were submitted for laboratory analysis. In areas where no contaminants were detected, a minimum of two liners were submitted for laboratory analysis to confirm the absence of contaminants. Capping consisted of placing a 4-in. wide section of Teflon® tape between the liner and a tightly fitting plastic end cap. Samples were labeled and placed on ice per sample handling protocols listed on Table 2-2.

Soils contained in the remaining three liners were submitted for field GC analysis and/or were used for field descriptions. Field descriptions were logged according to the Unified Soil Classifications System (USCS). Prior to leaving the field, all borings were backfilled with a cement/bentonite mixture and the locations were surveyed by a land surveyor registered in the state of Illinois. Borehole logs for each boring are included in Appendix C. Sample locations and a discussion of the significance of the analytical results is included in Section 3.

2.5.1.2 Hand-Augered Soil Sampling

In April 1993 seven hand-augered soil samples were collected from three locations on base. All hand-augered soil samples collected from on base were used for background determination. The hand-augered samples were collected using an AMS brand soil recovery auger which accommodates 2 x 8 in. stainless steel sleeves. Once the desired sampling depth was reached, a decontaminated liner and auger head were used to collect an undisturbed soil sample. Prior to capping the liner a PID reading was taken and recorded to assure that no obvious contamination existed in the soils. As with the split spoon samples, 4-in. Teflon® tape was placed between the liner and a tightly-fitting plastic cap. These samples were labelled and immediately placed on ice per sample handling requirements listed on Table 2-2. Soil sampling forms are included in Appendix H of this report.

2.5.2 Surface Water/Sediment Sampling Activities

Surface water and sediment samples were collected from three locations within the pond at Site 2. Surface water samples were collected by directly filling the sample containers with pond water. Filtered samples for metals analyses were collected using a decontaminated Teflon® bailer and a disposable, 0.45 µm filter. Sediment samples were collected using the hand auger extension rods

**Table 2-2 Laboratory Analytical Methods Summary
ILANG, 183rd FG, Capital Airport, Springfield, Illinois**

Parameter	Analytical Method	Matrix	Holding Time (From time of Collection)	Container	Preservative	Minimum Sample size
Volatile Organics	SW ¹ 8010 and 8020 SW ¹ 8240	Water Soil	14 days 14 days	Two 40-mL vials with Teflon-lined caps, Brass or Teflon core tube sealed on both ends	HCl to pH < 2 4° C 4° C	40 mL 10 g
Semivolatile Organics (including pesticides and PCBs)	EPA ² CLP EPA ² CLP	Water Soil	7 days extraction 40 days analysis 14 days extraction 40 days analysis	1-L glass with Teflon Liner Brass or Teflon core tube sealed on both ends	4° C 4° C	1000 mL 50g
Metals (other than mercury)	EPA ³ CLP EPA ³ CLP	Water Soil	180 days 180 days	Glass Brass or Teflon core tube sealed on both ends	HNO ₃ to pH < 2 4° C	100 mL 10 g
Mercury	EPA ³ CLP EPA ³ CLP	Water Soil	28 days 28 days	Glass Brass or Teflon core tube sealed on both ends	HNO ₃ to pH < 2 4° C	100 mL 10 g

Notes:

SW¹ refers to Environmental Protection Agency (EPA) "Test Methods for Evaluating Solid Waste - Physical/Chemical Methods", SW-846, 3rd Edition, November 1988.

EPA² refers to EPA CLP, Statement of Work (SOW) for Organics Analysis, Multi-Media, Multi-Concentration", Document No. OLM01.8, March 1990.

EPA³ refers to EPA CLP, SOW for Inorganics Analysis, Multi-Media, Multi-Concentration", Document No. ILM03.0, February 1988.

°C - degrees centigrade

g - grams

HCL - hydrochloric acid

HNO₃ - nitric acid

L - liter

mL - milliliter

PCBs - polychlorinated biphenyls

and an AMS sludge sampler head. The sediment was collected in 3 in. x 12 in. stainless steel liners which were capped with Teflon® tape and tightly-fitting plastic end caps. After the liners were collected they were labeled and placed on ice per sample handling requirements listed in Table 2-2. Sampling forms are included in Appendix H of this report.

2.5.3 Monitoring Well Installation, Development and Sampling

The procedures used from monitoring well installation, development, and sampling are included below.

2.5.3.1 Monitoring Well Installation

Optimal monitoring well locations were determined after a round of groundwater elevation measurements were obtained from the piezometers and the hydraulic gradient determined for each site. The wells were installed using the hollow-stem auger method of drilling. Auger holes were drilled to a depth approximately 1 to 2 ft deeper than the proposed bottom of the well cap. Because of the relatively high clay content in the soils, the auger holes were very stable. The augers were removed from the hole and the wells constructed in open hole. Monitoring well casing caps and screen were constructed of threaded, flush joint, 2-in. diameter Schedule 304 stainless steel. Screen lengths were 10-ft continuous sections of wire-wound screen containing 0.010 in. openings. Prior to placement of the well materials in the hole, the screen, cap, and riser were steam cleaned.

Once the well materials were positioned in the borehole such that the screened interval was intersecting the water table, 20/40 graded Colorado silica sand was placed in the annular space to a height approximately 2 ft above the top of the screen. A 2 ft thick bentonite pellet layer was placed above the sand and hydrated to form a seal. The remaining annular space was filled with a Type I Portland cement/bentonite mixture (approximately 95% cement to 5% bentonite) to a depth approximately 0.5 ft below grade. The wells were finished by installing either 9-in. diameter flush-mount drive over boxes (for Site 1 wells) or a 2 ft tall locking protective surface casing (for Site 2 wells). Locking expandable caps were placed on each well casing and the wells were finished by pouring a 2 ft by 2 ft surface pad. The stick up well casings were protected from mowing machines, etc. by three cement filled guard posts placed in the ground around the well. Each well casing had a small notch cut in the top (for a survey reference marker) prior to well installation. Survey markers were placed in the concrete well pad. Well numbers were stenciled into the markers during the survey operations. Monitoring well construction forms are included in Appendix C.

2.5.3.2 Monitoring Well Development

After installation, all seven of the monitoring wells were developed to remove fine-grained sediments from the filter pack and to repair damage done to the formation by the drilling operations to restore the natural hydraulic properties of the formation. A minimum of 24 hr was allowed to pass after the wells were installed before development began. This time allowed set up of the cement bentonite grout used to seal the annular space. A Teflon® bailer was used to purge stagnant water from the wells. Development proceeded until: the groundwater removed from the wells became noticeably less turbid and the turbidity showed no signs of decreasing further; a minimum of 10 well volumes of water were removed from each well; and measurement of pH, temperature and conductivity, incrementally recorded during development, remained stable within $\pm 10\%$ for three consecutive measurements. All water removed from the wells during development was stored in polyethylene tanks and disposed of as stated in Section 2.8. Well development forms are included in Appendix H.

2.5.3.3 Groundwater Sampling and Analysis

After waiting for at least 24-hours after development, the monitoring wells were allowed to recharge, purged, and then sampled. The volume of water in each well casing was calculated prior to purging. As required in the Field Sampling Plan (FSP) - Earth Technology, 1992, from 4 to 5 casing volumes were removed from each well during the purging process. A decontaminated Teflon® bailer was used to remove the stagnant groundwater from each well. Color, degree of turbidity, odor and other physical properties of the water were recorded during development. Additionally, measurement of the pH, temperature, and conductivity of the groundwater were obtained before and after purging, and prior to sampling.

These data were collected to ensure a representative groundwater sample was being collected. After purging, and before sampling, the wells were allowed to recharge to greater than 80% of their pre-purging volume.

Samples were collected using a Teflon® bailer in the following order: VOCs first, followed by the other volumes required for organic analysis and finally metals. Filtered metals were collected by positioning a disposable 0.45 μm pore size filter on the end of the bailer and using a hand pump assembly to move the water through the filter. The samples were labeled and immediately placed on ice per sample handling procedures detailed in Table 2-2. Pre-preserved bottles (if needed) were used during the sampling process. Preservative types are also listed on Table 2-2. Groundwater sampling forms are included in Appendix H.

2.6 BACKGROUND SAMPLING RESULTS

Because metals were identified as potential contaminants of concern for Site 1 (lead only) and Site 2, seven soil samples were collected and analyzed at three locations on the base to provide data on the facility background concentrations of these analytes. The samples were collected with a hand auger (Section 2.5.1.2) from areas determined by Base Civil Engineering (BCE) personnel to be relatively undisturbed by human activity. The locations of these soil samples, their relationship to the sites under investigation, and the background analytical results are discussed in Section 3.5. Soil sampling forms are included in Appendix H.

2.7 SURVEYING

The horizontal locations in Illinois State Plane Coordinates and elevations in feet above mean sea level (MSL) were determined for all soil borings, piezometers, monitoring wells, surface soil, sediment and surface water samples. The top of the monitoring well and piezometer casings were notched to provide a reference point for the land surveyors and for subsequent water level elevation measurements. All surveying information is provided in Appendix I.

2.8 DISPOSAL OF WASTES AND SOIL CUTTINGS FROM FIELD ACTIVITIES

Soil cuttings and development, purge, and decontamination water were generated during the field activities. All soil cuttings were placed in drums until the completion of field activities. The wastewater was placed in 500 gallon polyethylene tanks. Soil cuttings which indicated the presence of elevated concentrations of contaminants, as determined by laboratory analysis of soil samples from each borehole, were submitted for EPA SW-846 toxicity characteristic leaching procedure (TCLP) analyses (EPA 1986). TCLP analytical results are included in Appendix J. All cuttings were determined to be Resource Conservation Recovery Act (RCRA) non-hazardous. Since all borings

showed detectable levels of contaminants of concern, all cuttings were disposed as special waste, per Illinois Environmental Protection Agency (ILEPA) recommendations.

A composite sample of the wastewater was submitted for analysis of compounds requested by the Springfield Metro Sanitary District authorities. After gaining approval from the district the water was disposed of through sanitary sewer system.

3.0 SIGNIFICANCE OF RESULTS

The results of the 1992 and 1993 SI program conducted at ILANG, Capital Airport are discussed in this section. The SI program consisted of soil gas, soil, and groundwater screening; drilling soil borings; installing monitoring wells; soil, sediment, surface water and groundwater sampling; and aquifer slug testing.

Section 3.1 addresses the general geology and hydrogeology of the base. Section 3.2 through 3.4 summarizes the quality QA/QC results for the program. Section 3.5 discusses the results of the background soil sampling. Sections 3.6 and 3.7 provide site specific information on the screening, sampling, and analytical results.

The data interpretations presented in this section are based on data collected during this investigation and previous investigations where applicable. The data tables included in this section present only those compounds and analytes for which a positive result was detected in at least one sample. The complete listing of analytical results is contained in Appendix G.

3.1 BASE GEOLOGY AND HYDROGEOLOGY

A general description of the geology and hydrogeology of the two areas under investigation is presented in the following subsections. The geology and hydrogeology of each site is discussed in detail in the Sections 3.4.1 and 3.5.1. Information regarding site-specific soil types was obtained by field description of split spoon samples collected during drilling operations. Soil borings SB101 and SB201 (one boring per site) were continuously sampled until bedrock (refusal) was encountered. Subsequent borings were sampled either at 2 ft intervals (0 to 2 ft, 4 to 6 ft, 8 to 10 ft, etc.) or continuously sampled until the water table was reached. Borings were generally advanced only a few feet below the water table before they were abandoned. Additionally, one soil sample per site was collected and analyzed for geotechnical parameters. Hydrogeologic data obtained during the investigation includes groundwater elevation data and aquifer slug tests.

3.1.1 Geology

The regional geologic setting in the vicinity of Capital Airport was previously presented in Section 1.6 of this report. Subsurface soils, as described in the field, are of similar consistency between the two sites. In general, the near-surface soils in the area are dark brown-brown, organic-rich clays with variable amounts of silt and fine-grained sand. This surficial clay unit is underlain at depth by a silty clay or silt unit. The silt is not present in all borings, but when present occurs at depths ranging from 4.5 to 8.5 ft bgs. The silt is grey-brown to light brown colored and contains minor amounts of sand and clay. A majority of the borings drilled on base did not fully penetrate the silt unit. However, where data is available a lower clay unit underlies the silt unit. From field descriptions obtained during the drilling of the two deep borings, the clay unit is more compacted (stiffer consistency) below approximately 15 ft. Refusal was encountered in SB101 and SB201 at 21.5 and 26 ft bgs, respectively. A relatively thin sand and/or gravelly clay unit, approximately 2.5 ft thick, was encountered prior to refusal of the hollow stem augers on top of a gravelly-clay/weathered shale unit. This unit probably represents the weathered remains of the Pennsylvania-aged sedimentary bedrock (Bergstorm et al, 1976), and is likely equivalent to the "hard pan" described by local water well drillers (see boring logs in the Appendix of the SI WP [The Earth Technology Corporation, September 1992]).

One vadose zone soil sample was collected from each site using a Shelby tube sampler. Each sample was then analyzed for the following geotechnical parameters: grain size, clay mineralogy, specific gravity, Atterberg limits, moisture content, cation exchange capacity (CEC), and permeability. The results pertinent to this discussion are presented in Table 3-1. The complete report is presented in Appendix C.

Table 3-1 Geotechnical Properties of Site 1 and 2 Soils

Location	Depth (ft)	USCS	Grain-size Analysis				Coefficient of Permeability (ft/min)
			% Gravel	% Sand	% Silt	% Clay	
MW103	3-5	CL	0	0.8	64.9	34.3	1.59 x 10 ⁻⁶
MW203	4-6	CL	0	2.1	70.9	27	2.5 x 10 ⁻⁶

Grain size analysis shows this unit to be composed primarily of silt with clay. These data, combined with the results of the Atterberg Limits analysis (used to determine the plasticity of the soils) provided a USCS of Clay (CI) for each sample. The coefficients of permeability for these samples are low, indicating the soils at the two sites have relatively low infiltration rates and low hydraulic conductivities.

3.1.2 Base Hydrogeology

Data regarding the occurrence and flow of groundwater in the shallow aquifer were collected at the specific sites of interest. No additional basewide hydrogeologic measurements were obtained. Therefore, discussions regarding groundwater flow directions, and hydraulic conductivity, transmissivity and velocity for the surficial aquifer are presented during the site-specific discussions in Sections 3.6.1 and 3.7.1. Construction details and measured static water levels (November 23, 1992, December 7, 1992, and April 12, 1993) for the piezometers and monitoring wells installed during the field investigations are presented in Table 3-2.

From the data presented in Table 3-2, groundwater occurs in the shallow, near-surface sediments at depths ranging from approximately 3 to 9.5 ft bgs. A comparison of water level elevations to the elevations to the top and base of the well screen shows that all wells are constructed with their screened interval intersecting the water table. The surficial aquifer ranges in thickness from approximately 15 to 20 ft, assuming bedrock occurs at the refusal depths noted for each site.

Aquifer slug test data were used to determine hydraulic conductivity (K) values for the shallow aquifer. K values were used in combination with porosity, hydraulic gradients, and aquifer thicknesses to determine average groundwater velocity (v) and transmissivity (T) values. The average groundwater velocity provides insight on the rate at which contaminants may be moving beneath a site, while transmissivity values provide an estimate of the amount of water that can be transmitted horizontally by the full saturated thickness of the aquifer. Data sources and the equations used in calculating v and T were either measured in the field or obtained from Freeze and Cherry (1979).

Table 3-2 Well Construction and Water Level Elevations,
ILANG, 183rd FG, Springfield, Illinois

Measured Location	Elevation in feet (toc) ^a	Elevation of Screened interval feet bgs (top-bottom)	Depth to water (btoc) ^a in feet 11-24-92	Elevation of groundwater 11-24-92	Depth to water (btoc) in feet 12-7-92	Elevation of groundwater 12-7-92	Depth to Water (btoc) in feet 4-12-93	Elevation of Groundwater 4-12-93
PZ101	582.48	575.58 - 570.58	5.76	576.72	6.24	576.24	6.26	576.22
PZ102	583.50	576.50 - 571.50	6.94	576.56	7.57	575.93	8.08	575.42
PZ103	582.50	576.50 - 571.50	5.74	576.76	6.01	576.49	6.06	576.44
PZ104	583.78	579.58 - 569.58	NA	NA	6.28	577.50	6.07	577.71
MW101	580.78	576.58 - 566.58	NA	NA	8.11	572.67	7.93	572.85
MW102	582.41	579.21 - 569.32	NA	NA	4.24	578.17	4.10	578.31
MW103	583.00	578.80 - 568.80	NA	NA	7.24	575.76	7.26	575.74
MW104	582.15	578.35 - 568.35	NA	NA	7.25	574.90	6.83	575.32
PZ201	586.29	576.49 - 571.49	7.89	578.40	8.43	577.86	9.37	576.92
PZ202	585.00	578.10 - 573.10	5.71	579.21	6.82	578.18	6.18	578.82
PZ203	585.14	578.98 - 573.98	7.86	577.28	9.15	575.99	8.80	576.34
MW201	586.81 ^b	582.61 - 572.61	NA	NA	11.18	575.63	11.02	575.79
MW202	583.05 ^b	581.05 - 571.05	NA	NA	5.69	577.36	5.64	577.41
MW203	588.08 ^b	584.08 - 574.08	NA	NA	9.21	578.87	8.61	579.47

NOTES: All measurements are in feet; all elevations are in feet above sea level.

(a) toc = top of casing

(b) Wells MW201 - MW203 are constructed with the top of the riser approximately 2.5 ft above ground level

(c) The remaining wells and piezometers are constructed approximately parallel with the ground surface

btoc = below top of casing

NA = not applicable

The equation used to calculate v is:

$$v = \frac{K}{n} \frac{dh}{dl}$$

where:

K = hydraulic conductivity

n = porosity (assumed to be 37.5% for silt)

$\frac{dh}{dl}$ = hydraulic gradient

dl

v = velocity

while for T it is:

$T = K(b)$

where:

T = transmissivity

K = hydraulic conductivity

b = thickness of aquifer (average of 20 ft or 609.9 cm).

Average v and T calculations are included for Site 1 in Section 3.6.1 and for Site 2 in Section 3.7.1.

3.2 QA/QC INTRODUCTION

A standardized QA/QC program was followed during the SI at ILANG, Capital Airport to ensure that analytical results accurately represent the environmental conditions at the sites. The SI was conducted using the HAZWRAP Level C QC requirements (i.e., EPA Level III) described in Requirements For Quality Control Of Analytical Data (DOE/HWP-65/R1, July 1990) and the guidelines and specifications described in the SI Work Plan.

A total of 57 environmental samples were taken at the ILANG, Capital Airport. The environmental samples consisted of 37 soil, 17 water, and 3 sediment samples. In addition to the environmental samples 26 QC samples were taken. The QC samples included 6 field duplicates, 6 equipment rinseates, 6 field blanks, and 12 trip blanks. A summary of the number of samples taken at each site, sample matrix, and analysis performed on the samples is presented in Table 3.3.

3.2.1 Data Quality Objectives

Data quality objectives (DQOs) are qualitative and quantitative statements which specify the quality of the data required to support decisions during remedial response activities. The following sections summarize the qualitative and quantitative DQOs for precision, accuracy, representativeness, comparability, and completeness (PARCC) obtained during the SI. Quantitative goals for the PARCC parameters precision, accuracy, and completeness were established in the ILANG Capital Airport Quality Assurance Project Plan (QAPP). The numerical goal for the PARCC parameters precision, accuracy, and completeness was 90%.

Table 3-3 Sampling and Analysis Summary
ILANG, Capital Airport, Springfield, Illinois

Sample Source	Matrix	VOC SW846 8010/8020 ¹	SVOC CLP 3/90	TAL Metals CLP 3/90	PCB/ Pesticides CLP 3/90
Site 1	Soil	17	17	17 ²	2
	Water	8	8	16 ^{2,3}	1
Site 2	Soil	15	15	15	15
	Water	9	9	18 ³	9
	Sediment	3	3	3	3
Facility Background	Soil	6	6	6	6
Total	Soil	38	38	38	23
	Water	17	17	34 ³	10
	Sediment	3	3	3	3
Field Duplicates	Soil	4	4	4	3
	Water	2	2	4	1
	Sediment	0	0	0	0
Equipment Rinseates	Water	6	6	6	5
Trip Blanks	Water	12	-	-	-
Field Blanks	Water	6	6	6	6

¹ SW846 8010/8020 analysis was performed on all water samples, SW846 8240 was performed on all soil samples. Confirmation was performed for those samples containing compounds greater than detection levels.

² Lead only at Site 1.

³ Filtered and unfiltered water samples were collected.

3.2.1.1 Precision

Precision refers to the level of agreement among repeated measurements of the same characteristic, under a given set of conditions. Precision is expressed quantitatively as the measure of the variability of a group of measurements compared to their average value. Precision was defined as the reproducibility, or degree of agreement, among replicate measurements of the same quantity. For this project, the precision of the analytical and sampling techniques were assessed through the collection and analysis of field duplicate samples and the performance of analytical replicates. A DQO of 90% was established for the ILANG, Capital Airport SI. The closer the numerical values of the measurements are to each other, the more precise the measurement. Analytical precision was expressed as the percentage of the difference between results of duplicate samples for a given compound or element.

Overall precision was composed of both analytical and sampling precision. Analytical precision was determined using matrix spike/matrix spike duplicate (MS/MSD) analysis. Sampling precision was determined using field duplicate sample analyses. MS/MSD and duplicate sample analysis was conducted on samples collected for VOC, SVOC, TAL metals, and pesticides/PCBs analyses during the ILANG, Capital Airport SI.

The laboratory prepared MS/MSD samples by selecting 1 sample in 20 and splitting the sample into 2 additional aliquots. One aliquot was screened, to obtain an estimate of the concentrations of the parameters of interest before analysis. The remaining aliquot was split and spiked with known quantities of the parameters of interest before analysis. The relative percent difference (RPD) between the spike results was calculated and used as an indication of the analytical precision for the VOC, SVOC, and Pesticide/PCB analyses performed. Duplicate samples for TAL metal analyses were prepared by subdividing 1 sample of every 20 samples received and analyzing both samples of the duplicate pair. The RPD between the two detected concentrations was calculated and used as an indication of the analytical precision for the analyses performed.

Six of 130 RPD values calculated from the water VOC analyses exceeded control limit of 20% for analytical precision. Three of 67 RPD values calculated from the soil VOC analyses exceeded the appropriate control limits for analytical precision. Control limits for the matrix spike/matrix spike duplicate RPDs for water and soil VOCs are detailed in Tables 3-4 and 3-5. One of the 11 RPD water values calculated from the SVOC analyses exceeded the appropriate control limits for analytical precision. Control limits for the matrix spike/matrix spike duplicate RPDs for water and soil SVOCs are detailed in Tables 3-6 and 3-7.

Fourteen of 24 calculated RPD soil values for Pesticides/PCBs were outside of advisory control limits. Six of 12 calculated water RPD values for Pesticides/PCBs were outside of advisory control limits. Control limits for the matrix spike/matrix spike duplicate RPDs for water and soil Pesticides/PCBs are detailed in tables 3-8 and 3-9. Six of 55 RPD soil values calculated from TAL metals analyses were outside advisory control limits of 20%. Five of 47 RPD water values calculated from TAL metals analyses were outside control limits of 20%. The RPD control limits for the sample spike and duplicate analysis for water and soil TAL metals are detailed in Tables 3-10 and 3-11.

The results for soil are considered to have little impact on the environmental data quality and considered more likely to be the result of the heterogeneous matrix variability. Water RPD values which exceeded control limits are most likely due to the unequal distribution of suspended minute particulates that could not be evenly distributed by well development procedures and mixing procedures since the analytical QC results do not indicate a systemic laboratory problem. The MS/MSD results indicate that overall 41 of the 390 RPD values calculated exceeded the relative criteria. This indicates a 90% laboratory precision.

Field Replicates

Field replicates were used as a measure of the sampling precision at the ILANG, Capital Airport. The field replicate for each soil analyses was obtained from the adjacent sleeve and water samples were split into different sample containers upon sampling. Four replicated soil pairs and two replicate water pairs were used to evaluate sample collection reproducibility and matrix variability at ILANG Capital Airport. Field RPD values were calculated for compounds and elements detected above the Contract Required Detection Limits (CRDL) in one of the replicate pairs.

Two of 2 soil RPD values calculated exceeded the 35% control limit. One of 1 water RPD value calculated for VOCs were greater than 20%. The RPDs values that exceeded the 35% ranged from 38% to 67%. One of 4 soil RPD values calculated for SVOCs exceeded 35% limit. The SVOC outlier reported a RPD value of 59%. There were no SVOCs detected above the CRDL in any of the sample duplicate pair. Twenty-two of the 52 soil RPD calculated for metals were greater than 35%. The RPDs that exceeded the 35% limit ranged between 43% to 200%. Eleven of the 21 water RPD values calculated for metals were greater than 20%. The RPDs that exceeded the 20% limit ranged from 43% to 199%. Five soil RPD values were calculated for pesticides/PCBs. All of the

TABLE 3-4 LABORATORY QUALITY CONTROL SUMMARY: WATER MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8010										
Bromodichloromethane	6	101-121	42-172	6	0	3	-4-13	20	3	0
Bromobenzene	6	66-113	60-90	6	0	3	6-9	20	3	0
Bromoform	6	80-158	13-159	6	0	3	0-9	20	3	0
Bromomethane	6	76-125	1-144	6	0	3	0-4	20	3	0
Bromochloromethane	4	84-98	4-133	4	0	2	0-6	20	2	0
Carbon tetrachloride	6	94-100	43-143	6	0	3	1-5	20	3	0
2-Chloroethylvinyl eter	6	0	14-186	0	6	3	0	20	3	0
Chloroethane	6	0-125	46-137	4	2	3	0-5	20	3	0
Chloroform	6	90-100	49-133	6	0	3	0-6	20	3	0
Cholorbenzene	6	91-141	38-150	6	0	3	7-16	20	3	0
Chloromethane	6	0-119	1-193	4	2	3	0-12	20	3	0
2-Chlorotoluene	4	74-98	60-140	4	0	2	5-11	20	2	0
4-Chlorotoluene	4	93-104	60-140	4	0	2	2-8	20	2	0
1,2-Dibromoethane	4	91-110	24-191	4	0	2	2	20	2	0
Dibromochloromethane	6	85-118	24-191	6	0	3	1-7	20	3	0

TABLE 3-4 LABORATORY QUALITY CONTROL SUMMARY: WATER MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8010										
Dibromomethane	6	85-105	42-172	6	0	3	7-18	20	3	0
1,2-Dichlorobenzene	4	89-105	1-208	4	0	2	10-12	20	2	0
1,3-Dichlorobenzene	4	93-104	7-187	4	0	2	2-11	20	2	0
1,4-Dichlorobenzene	4	95-125	42-143	4	0	2	0-3	20	2	0
1,1-Dichloroethane	6	90-105	47-132	6	0	3	-7-12	20	3	0
1,2-Dichloroethane	6	85-107	51-147	6	0	3	-7-3	20	3	0
1,1-Dichloroethene	6	65-113	28-167	6	0	3	1-39	20	2	1
trans-1,2-Dichloroethene	6	88-103	38-155	6	0	3	2-8	20	3	0
1,2-Dichloropropane	6	89-103	44-156	6	0	2	0-7	20	3	0
cis-1,3-Dichloropropene	6	86-106	22-178	4	0	3	0-14	20	2	0
trans-1,3-Dichloropropene	6	94-118	22-171	6	0	3	3-4	20	3	0
Methylene Chloride	6	0-104	25-162	4	2	3	0-31	20	2	1
1,1,2,2-Tetrachloroethane	6	94-144	8-184	6	0	3	6-9	20	3	0
1,1,1,2-Tetrachloroethane	6	90-97	38-150	6	0	3	2-9	20	3	0

TABLE 3-4 LABORATORY QUALITY CONTROL SUMMARY: WATER MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8010										
Tetrachloroethene	6	94-104	26-162	6	0	3	-1-7	20	3	0
1,1,1-Trichloroethane	6	85-100	41-138	6	0	3	0-9	20	3	0
1,1,2-Trichloroethane	6	90-178	39-136	4	0	3	0-4	20	3	0
Trichloroethene	6	38-106	35-146	6	0	3	2-7	20	3	0
Trichlorofluoromethane	2	92-94	17-181	2	0	1	2	20	1	0
1,2,3-Trichloropropane	4	80-108	60-140	4	0	2	5-10	20	2	0
Vinyl Chloride	6	81-125	26-163	6	0	3	0-25	20	2	1
8020										
Benzene	6	83-97	39-150	6	0	3	1-16	20	3	0
Ethyl benzene	6	70-133	37-162	6	0	3	3-16	20	3	0
Chlorobenzene	6	71-141	38-150	6	0	3	3-16	20	3	0
Methyl-tert-butyl-ether	4	70-90	28-167	4	0	2	10-14	20	2	0
Styrene	4	63-106	32-160	4	0	2	0-9	20	2	0
Toluene	6	78-102	46-148	6	0	3	3-15	20	3	0
1,4-Dimethylbenzene	4	69-88	55-135	4	0	2	7-12	20	2	0
1,3-Dimethylbenzene	4	69-118	55-135	4	0	2	7-16	20	2	0

TABLE 3-4 LABORATORY QUALITY CONTROL SUMMARY: WATER MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

		Accuracy				Precision					
		Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8020											
1,2-Dimethylbenzene		4	72-89	55-135	4	0	3	10-17	20	3	0
m,o-Xylene		2	123-188	32-162	1	1	1	42	20	0	1
1,2-Dichlorobenzene		6	67-171	1-208	6	0	3	7-20	20	3	0
1,3-Dichlorobenzene		6	70-181	7-187	6	0	3	7-22	20	2	1
1,4-Dichlorobenzene		6	72-186	42-143	4	2	3	7-21	20	2	1

TABLE 3-5 LABORATORY QUALITY CONTROL SUMMARY: SOIL MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8010										
Bromodichloromethane	2	94-102	42-172	2	0	1	8	20	1	0
Bromobenzene	2	94-109	60-90	2	0	1	15	20	1	0
Bromoform	2	109-123	13-159	2	0	1	12	20	1	0
Bromomethane	2	87-105	1-144	2	0	1	19	20	1	0
Bromochloromethane	2	109-116	4-133	2	0	1	6	20	1	0
Carbon tetrachloride	2	87-102	43-143	2	0	1	16	20	1	0
2-Chloroethylvinyl eter	2	94-116	14-186	2	0	1	21	20	1	0
Chloroethane	2	94-105	46-137	2	0	1	11	20	1	0
Chloroform	2	84-91	49-133	2	0	1	8	20	1	0
Cholorbenzene	2	94-109	38-150	2	0	1	15	20	1	0
Chloromethane	2	65-116	1-193	2	0	1	56	20	0	1
2-Chlorotoluene	2	87-102	60-140	2	0	1	16	20	1	0
4-Chlorotoluene	2	94-102	60-140	2	0	1	8	20	1	0
1,2-Dibromoethane	2	123-131	24-191	2	0	1	6	20	1	0
Dibromochloromethane	2	102-109	24-191	2	0	1	7	20	1	0

TABLE 3-5 LABORATORY QUALITY CONTROL SUMMARY: SOIL MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy				Precision					
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8010										
Dibromomethane	2	116-138	42-172	2	0	1	17	20	1	0
1,2-Dichlorobenzene	2	87-94	1-208	2	0	1	8	20	1	0
1,3-Dichlorobenzene	2	73-94	7-187	2	0	1	25	20	1	0
1,4-Dichlorobenzene	2	80-87	42-143	2	0	1	8	20	1	0
1,1-Dichloroethane	2	87-94	47-132	2	0	1	8	20	1	0
1,2-Dichloroethane	2	109	51-147	2	0	1	0	20	1	0
1,1-Dichloroethene	2	87-94	28-167	2	0	1	11	20	1	0
trans-1,2-Dichloroethene	2	87-102	38-155	2	0	1	16	20	1	0
1,2-Dichloropropane	2	87-102	44-156	2	0	1	16	20	1	0
cis-1,3-Dichloropropene	2	96-103	22-178	2	0	1	7	20	1	0
trans-1,3-Dichloropropene	2	93-100	22-171	2	0	1	7	20	1	0
Methylene Chloride	2	117-131	25-162	2	0	1	8	20	1	0
1,1,2,2-Tetrachloroethane	2	109-138	8-184	2	0	1	30	20	1	0
1,1,1,2-Tetrachloroethane	2	94-109	38-150	2	0	1	15	20	1	0

TABLE 3-5 LABORATORY QUALITY CONTROL SUMMARY: SOIL MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8010										
Tetrachloroethene	2	87-102	26-162	2	0	1	16	20	1	0
1,1,1-Trichloroethane	2	108-115	41-138	2	0	1	6	20	1	0
1,1,2-Trichloroethane	2	102-109	39-136	2	0	1	7	20	1	0
Trichloroethene	2	87-94	35-146	2	0	1	8	20	1	0
1,2,3-Trichloropropane	2	109-160	60-140	2	0	1	38	20	0	1
Vinyl Chloride	2	91-109	26-163	2	0	1	18	20	1	0
8020										
Benzene	2	80-94	39-150	2	0	1	16	20	1	0
Ethyl benzene	2	80-94	37-162	2	0	1	16	20	1	0
Chlorobenzene	2	80-94	38-150	2	0	1	16	20	1	0
Methyl-tert-butyl-ether	2	103-107	28-167	2	0	1	4	20	1	0
Styrene	2	80-94	32-160	2	0	1	16	20	1	0
Toluene	2	76-91	46-148	2	0	1	18	20	1	0
1,4-Dimethylbenzene	2	80-94	55-135	2	0	1	16	20	1	0
1,3-Dimethylbenzene	2	80-94	55-135	2	0	1	16	20	1	0

TABLE 3-5 LABORATORY QUALITY CONTROL SUMMARY: SOIL MS/MSD VOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
8020										
1,2-Dimethylbenzene	2	79-93	55-135	2	0	1	16	20	1	0
1,2-Dichlorobenzene	2	72-86	1-208	2	0	1	18	20	1	0
1,3-Dichlorobenzene	2	73-94	7-187	2	0	1	25	20	0	1
1,4-Dichlorobenzene	2	76-91	42-143	2	0	1	18	20	1	0
GC/MS										
1,1-Dichloroethene	8	57-105	59-172	8	0	4	3-13	22	4	0
Trichloroethene	8	61-107	62-137	8	0	4	1-9	24	4	0
Benzene	8	77-106	66-142	8	0	4	2-10	21	4	0
Toluene	8	75-121	59-139	8	0	4	2-10	21	4	0
Chlorobenzene	8	73-104	60-133	8	0	4	1-12	21	4	0

TABLE 3-6 LABORATORY QUALITY CONTROL SUMMARY:
WATER MS/MSD SEMIVOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number		MSD Total No. Analyses	Range RPD	RPD Limits	Number	
				Within Control Limits	Outside Control Limits				Within Limits	Outside Limits
Phenol	2	65-67	11-89	2	0	1	3	42	1	0
2-Chlorophenol	2	62-67	27-123	2	0	1	8	40	1	0
1,4-Dichlorobenzene	2	59	36-97	2	0	1	0	28	1	0
n-Nitroso-di-n-propylamine	2	80-86	41-116	2	0	1	7	38	1	0
1,2,4-Trichlorobenzene	2	63	38-98	2	0	1	0	28	1	0
4-Chloro-3-methylphenol	2	73-80	23-97	2	0	1	9	42	1	0
Ancenapthene	2	64-71	46-118	2	0	1	10	31	1	0
4-Nitrophenol	2	80-100	10-80	1	1	1	22	50	1	0
2,4-Dinitrotoluene	2	73-78	24-96	2	0	1	7	38	1	0
Pentachlorophenol	2	100	9-103	2	0	1	0	50	1	0
Pyrene	2	45-80	26-127	2	0	1	56	31	0	1

TABLE 3-7 LABORATORY QUALITY CONTROL SUMMARY:
SOIL MS/MSD SEMIVOLATILE ORGANIC COMPOUNDS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number		MSD Total No. Analyses	Range RPD	RPD Limits	Number	
				Within Control Limits	Outside Control Limits				Within Limits	Outside Limits
Phenol	8	39-74	26-90	8	0	4	10-19	35	4	0
2-Chlorophenol	8	43-61	25-102	8	0	4	3-17	50	4	0
1,4-Dichlorobenzene	8	37-64	28-104	8	0	4	0-22	27	4	0
n-Nitroso-di-n-propylamine	8	39-95	41-126	7	1	4	4-35	38	4	0
1,2,4-Trichlorobenzene	8	40-67	38-107	8	0	4	0-20	23	4	0
4-Chloro-3-methylphenol	8	45-81	26-103	8	0	4	0-28	33	4	0
Ancenapthene	8	43-71	31-137	8	0	4	5-18	19	4	0
4-Nitrophenol	8	39-77	11-114	8	0	4	0-21	50	4	0
2,4-Dinitrotoluene	8	20-71	28-89	7	1	4	0-33	47	4	0
Pentachlorophenol	8	35-90	17-109	8	0	4	3-18	47	4	0
Pyrene	8	41-83	35-142	8	0	4	11-32	36	4	0

wp/3-7.415-August 23, 1994

TABLE 3-8 LABORATORY QUALITY CONTROL SUMMARY: WATER MS/MSD PESTICIDES/ PCB
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
gamma- BHC	4	22-118	56-123	3	1	2	0-137	15	1	1
Heptachlor	4	12-110	40-131	3	1	2	3-161	20	1	1
Aldrin	4	16-142	40-120	3	1	2	3-142	22	1	1
Dieldrin	4	19-145	52-126	3	1	2	1-145	18	1	1
Endrin	4	0-200	56-121	3	1	2	21-200	21	1	1
4-4'-DDT	4	15-156	38-127	3	1	2	27-156	27	1	1

TABLE 3-9 LABORATORY QUALITY CONTROL SUMMARY: SOIL MS/MSD PESTICIDES/ PCB
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number		MSD Total No. Analyses	Range RPD	RPD Limits	Number	
				Within Control Limits	Number Outside Control Limits				Within Limits	Number Outside Limits
gamma- BHC	8	5-88	46-127	5	3	4	6-177	50	2	2
Heptachlor	8	4-124	35-130	7	1	4	7-182	31	2	2
Aldrin	8	4-100	34-132	6	2	4	0-178	43	2	2
Dieldrin	8	0-156	31-134	3	5	4	108-200	38	0	4
Endrin	8	5-134	42-139	6	2	4	0-182	45	1	3
4-4'-DDT	8	0-180	23-134	6	2	4	0-200	50	2	2

wpr3-9.415-August 23, 1994

TABLE 3-10 LABORATORY QUALITY CONTROL SUMMARY: WATER MS/MSD METALS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
Aluminum	2	105-120	75-125	2	0	2	5-176	20	1	1
Antimony	2	93-97	75-125	2	0					
Arsenic	2	94-102	75-125	2	0	2	4-52	20	1	1
Barium	2	97-104	75-125	2	0	2	4-60	20	1	1
Beryllium	2	101-108	75-125	2	0					
Cadmium	2	88-96	75-125	2	0					
Calcium	0					2	4-6	20	2	0
Chromium	2	98-104	75-125	2	0					
Cobalt	2	96-104	75-125	2	0	1	200	20	0	1
Copper	2	54-91	75-125	1	1					
Iron	2	81-115	75-125	2	0	2	6-192	20	1	1
Lead	2	61-79	75-125	1	1	1	200	20	0	1
Magnesium	0					2	2-4	20	2	0
Manganese	2	75-77	75-125	2	0	2	5	20	2	0
Mercury	2	86-91	75-125	2	0					
Nickel	2	97-102	75-125	2	0					
Selenium	2	80-90	75-125	2	0					
Silver	2	90-99	75-125	2	0					
Sodium	0					2	1-3	20	2	0
Thallium	2	59-77	75-125	1	1					
Vanadium	2	96-104	75-125	2	0	1	200	20	1	1
Zinc	2	97-104	75-125	2	0	2	97-200	20	0	2

calculated values exceeded the control limit of 35%. The RPDs ranged from 103% to 171%. All the pesticides/PCBs values were calculated from one sample/duplicated pair (CF-SB2-SS0.5-1 and CF-SB4-SS0.5-1). Overall these results indicate that 42 of the 85 RPD values calculated from the sample/duplicate pairs exceeded their respective control limits of 35% for soil samples and 20% for aqueous samples. This indicates a sampling precision of 51%. This is considered to have some impact on the environmental data quality. The poor agreement between the samples and duplicates is most likely a result of the sampling methods not being able to overcome the nonhomogeneity of the soils. Because samples were collected in liners and not composited for duplicate analysis, samples analyzed in the laboratory could be separated by as much as 12 inches. This amount of separation could have led to a discrepancy in the concentrations of the compounds and elements detected. A complete discussion of all replicate samples is presented in Appendix F.2.4.

As a result of the analytical and sampling precision an overall precision of 83% was obtained. These results are considered to have some impact on the precision of the environmental data.

3.2.1.2 Accuracy

Accuracy was defined as the degree of difference between measured or calculated values and the true value. The closer the numerical value of the measurement approaches the true value, or actual concentration, the more accurate the measurement. Analytical accuracy is expressed as the percent recovery (%R) of a compound or element that has been added to the environmental sample at a known concentration before analysis.

Laboratory accuracy was qualitatively assessed by evaluating the following laboratory QC information: sample holding times, method blank, tuning and mass calibration (gas chromatography/mass spectrometry [GC/MS] only), surrogate recovery (GC/MS only), internal standard (GC/MS only), Laboratory Control Sample (LCS) and method blank spike recovery, and initial and continuing calibration results calculated from all analyses conducted on environmental samples. Laboratory accuracy was quantitatively assessed by evaluating the %R of MS/MSD.

Percent Recoveries

Thirteen of 260 water percent recoveries were outside the control limits for MS/MSD analyses conducted on the samples collected and analyzed for VOCs. Established control limits for VOC percent recovery values are presented in Tables 3-4 and 3-5. Four of the eight water percent recovery values reported zero percent recovery for the spiked analytes. It appears that laboratory procedures rather than matrix interferences may have influenced the percent recoveries, since numerous QC problems were noted in the sample delivery group reporting zero percent spike recoveries. Zero of 134 soil percent recoveries values were outside the control limits for MS/MSD analyses conducted on the samples collected and analyzed for VOCs. The outliers noted for VOC analysis were all below acceptance criteria in the range between 0%-38% recovery. All supporting VOC QC information cited above was also qualitatively evaluated with respect to the analytical accuracy DQO. Four of the environmental samples collected for VOC analysis were analyzed one day beyond the applicable holding times, a number of second column confirmation runs were performed outside of holding times, and some compounds failed precision criteria during calibration. Detects for one aqueous sample delivery group analyzed for VOCs by SW-846 8010/8020 were not confirmed by GC methods as required. The detects were confirmed by GC/MS. The GC/MS method was capable of confirming those compounds which were detected by 8010/8020 at concentrations above 2 ppb. A comparison of these data to data obtained from a later sampling event from the same location and employing a second column GC confirmation, indicated comparable results for compounds requiring second column confirmation. Eight VOC data points were rejected for use

because the data was qualified "R" indicating unreliable results due to surrogate or internal standard recoveries. These results are not considered to have any adverse impact on the environmental data quality.

Two of 88 calculated percent recovery values was outside the control limits for the MS/MSD analyses conducted on the soil samples collected and analyzed for SVOCs. One of the 22 calculated percent recovery values were outside the control limits for the MS/MSD analyses conducted on the water samples collected and analyzed for SVOCs. Established control limits for SVOC percent recovery values are presented in Tables 3-6 and 3-7. The SVOC outliers reported recoveries of 20-100%. All supporting SVOC QC information cited above was also qualitatively evaluated with respect to the analytical accuracy DQO. Two samples within an aqueous sample delivery group reported poor surrogate recoveries for spiked compounds. Due to the lack of additional samples for reanalysis, one sample was not initially reanalyzed to confirm the possible matrix effect. In order to obtain additional sample for analysis, an additional sample was obtained, from the field, at a later date and reanalyzed. This resample reported acceptable surrogate recoveries. The second sample was diluted and reanalyzed and reported low but acceptable surrogate recoveries indicating a matrix effect. Seven SVOC samples reported internal standards which exceeded QC limits for area counts. The seven samples were reanalyzed and reported similar results which were attributed to matrix effects. Three other samples also reported internal standard area counts outside QC limits. Two of these samples were not reanalyzed due to laboratory error. The one sample which was reanalyzed did not indicate acceptable internal standard area counts on the re-analysis. The laboratory error in not reanalyzing the samples which indicated internal area counts outside QC limits and erratic results in the reanalysis of other samples resulted in the qualification of compounds as unusable. Seventy-three SVOC data points were rejected for use because the data was qualified "R" indicating unreliable results due to surrogate or internal standard recoveries. Numerous samples analyzed for SVOCs indicated detectable levels of common laboratory contaminants; these samples have been qualified "B" for blank contamination. These results are considered to have some impact on the environmental data quality.

Thirteen of 88 target analyte metals soil percent recovery values from the matrix spike analysis conducted on the soil samples exceeded recovery limits of 75-125% for soil. Three of 38 target analyte metal water percent recovery values from the matrix spike analyses conducted on the water samples exceeded recovery limits of 75-125%. Established control limits for VOC percent recovery values are presented in Tables 3-10 and 3-11. The outliers noted for TAL metals analysis were mixed high and low. The range of outliers noted for TAL metals were 304%-132% exceeding control limits of 75%-125%. All supporting target analyte metals QA information cited above were also qualitatively evaluated with respect to the analytical accuracy DQO. These results are not considered to have any adverse impact on the environmental data quality.

Fifteen of 48 soil percent recovery values for MS/MSD values obtained for Pesticide/PCB analysis were outside control limits listed in Tables 3-8 and 3-9. Six of 24 water percent recovery values for MS/MSD values obtained for Pesticide/PCB analysis were outside control limits. All supporting Pesticide/PCB QA information cited above was qualitatively evaluated with respect to the analytical accuracy DQO. Surrogate recoveries for numerous PCB samples were outside control limits. Since these surrogates are advisory, no action was taken. During PCB calibration, some compounds fell outside established retention windows; but the samples were bracketed by compliant QA standards, and no action was taken. All PCB outliers noted were low with a range from 0%-44% recovery falling below the control limit range of 40%-127%. The above results are not considered to have any adverse impact on the environmental data quality.

TABLE 3-11 LABORATORY QUALITY CONTROL SUMMARY: SOIL MS/MSD METALS
ILANG, CAPITAL AIRPORT, SPRINGFIELD, ILLINOIS

	Accuracy					Precision				
	Total No. Analyses	Percent Recovery Ranges	Percent Recovery Limits	Number Within Control Limits	Number Outside Control Limits	MSD Total No. Analyses	Range RPD	RPD Limits	Number Within Limits	Number Outside Limits
Aluminum	2	92-97	75-125	2	0	5	1-22	35	5	0
Antimony	5	12-97	75-125	2	3	1	200	35	0	1
Arsenic	5	52-99	75-125	4	1	4	2-25	35	4	0
Barium	5	85-91	75-125	5	0	5	0-15	35	5	0
Beryllium	5	96-103	75-125	5	0	3	1-200	35	2	1
Cadmium	5	80-104	75-125	5	0	1	26	35	1	0
Calcium	0					5	1-6	35	5	0
Chromium	5	93-108	75-125	5	0	3	7-9	35	3	0
Cobalt	5	90-102	75-125	5	0	3	1-8	35	3	0
Copper	5	94-101	75-125	5	0	5	0-6	35	5	0
Iron	2	92-101	75-125	2	0	5	3-52	35	4	1
Lead	5	-305-93	75-125	3	2	5	10-115	35	3	2
Magnesium	0					5	0-4	35	5	0
Manganese	5	68-303	75-125	3	2	5	1-34	35	5	0
Mercury	5	105-120	75-125	5	0	0				
Nickel	4	92-102	75-125	5	0	4	4-200	35	2	2
Potassium	0					5	0-13	35	5	0
Selenium	5	0-74	75-125	0	5	1	200	35	0	1
Silver	5	86-97	75-125	5	0	1	25	35	1	0
Sodium	0					5	0-40	35	4	1
Thallium	5	75-106	75-125	5	0	1	15	35	1	0
Vanadium	5	92-107	75-125	5	0	3	7-11	35	3	0
Zinc	5	79-93	75-125	5	0	5	0-25	35	5	0

A total of 10% of all calculated percent recovery values for soil and 6 of the percent recovery values for water exceeded control limits indicating that on average 92% accuracy was achieved. Sampling accuracy was maximized by adherence to the QA program presented in the SI QAPP. All procedures (i.e., soil boring installation, soil samples collection procedures, and health monitoring equipment calibration and operation) used during the SI were documented as standard operating procedures (SOPs). Field QA blanks (i.e., trip blanks, field blanks, and equipment rinseates) were prepared such that all samples represented the particular site from which they were collected, and assessed any cross-contamination that may have occurred. The environmental samples associated with the appropriate field QA samples were qualified based on the potential contaminants contained in the field QA samples.

3.2.1.3 Representativeness

Representativeness was defined as the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling location, a process condition, or an environmental condition. Sample representativeness was ensured during the SI by collecting sufficient samples of a population medium, properly distributed with respect to location and time. Representativeness was assessed by reviewing the drilling and sample collection methods used during the ILANG, Capital Airport SI, and evaluating the RPD values calculated from the duplicate samples and the concentrations of interferants detected in the field and laboratory QC blanks. The reproducibility of a representative set of samples reflects the degree of homogeneity of the sampled medium, as well as the effectiveness of the sampling techniques.

Soil samples were collected from two sites (Sites 1 and 2). All borings were advanced with a truck-mounted drilling rig using continuous-flight hollow stem augers. A minimum of two soil samples were collected for laboratory analysis from each soil boring. One sample was collected from just below the ground surface and the second from unsaturated soils just above the water table. A third and fourth sample were sometimes collected based on photoionization detector (PID) results and lithology. Samples were obtained using a split-spoon sampler equipped with stainless steel liners. Blow counts recording relative soil density were noted. Split-spoon samples were field-logged according to the USCS and field-screened with a PID meter and field GC for VOC concentrations. The boring was backfilled with a cement/bentonite slurry. The borings were marked at the surface and surveyed. Soil cuttings were placed in 55-gal drums for later analysis as required for disposal of the soil. Surface water samples were collected by directly filling the sample containers with pond water. Filtered samples for metals analyses were collected using a decontaminated Teflon® bailer and a disposable, 0.45 µm filter. Groundwater samples were obtained after development of each well. The monitoring wells were allowed to recharge, purged, and then sampled. The volume of water in each well casing was calculated prior to purging. As required, 4 to 5 casing volumes were removed from each well during the purging process. A decontaminated Teflon® bailer was used to remove the stagnant groundwater from each well. Color, degree of turbidity, odor and other physical properties of the water were recorded during development. Additionally, measurement of the pH, temperature, and conductivity of the groundwater were obtained before and after purging, and prior to sampling. These data were collected to ensure a representative groundwater sample was being collected.

Based on the evaluation of the factors described above and summarized in Appendix F the samples collected during the SI are considered to be representative of the environmental conditions at ILANG, Capital Airport.

3.2.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another and is limited to the other PARCC parameters, because only when precision and accuracy are known can one data set be compared to another. To optimize comparability, only the specific methods and protocols that were specified in the SI QAPP were used to collect and analyze samples during the SI. By using consistent sampling and analysis procedures, all data sets are comparable within the two sites at Ilang Capital Airport, between the two sites, or among ANG facilities nationwide. This consistency ensures that remedial action decision and priorities are based on a consistent data base.

All samples collected for VOC and SVOC analysis were analyzed using SW-846 8010/8020 (aqueous), SW-846 8240 (soils), and the 3/90 CLP Statement of Work (SOW), respectively. Samples collected for metals and pesticides/PCBs were analyzed using 3/90 CLP methods.

Based on the precision and accuracy assessment presented above, the data collected during the SI are considered to be comparable with the data collected during previous investigations.

3.2.1.5 Completeness

Completeness was defined as the percentage of usable obtained from a measurement system. DQOs for completeness are to meet a level of 85% usable data. Usable data, is data that has not been rejected during the data validation process. Based on the evaluation of the laboratory QC results for the 8,754 data points presented in Appendix I, these data were considered equal to 99%, and as such, were used as the basis of all recommendations presented in this report. Eight VOC, 73 SVOC, 13 TAL data points were rejected for use because the data was qualified "R" indicating unreliable results due to surrogate and internal standard recoveries. The VOC and SVOC data points which were qualified "R" are presented in Table F-10 of Appendix F.

Based on the evaluation of the laboratory QC results 99% of the total environmental data collected during the SI were used as the basis of all recommendations presented in this report. A complete list of all data points obtained during the SI is included in Appendix G.

3.3 FIELD QUALITY CONTROL ASSESSMENT

Twelve trip blanks, 6 field blanks, 6 equipment rinseates, and 6 field replicates were collected and analyzed by the same SOPs and methods used for the 57 environmental samples. Table F-11 of Appendix F contains a cross-reference of the associated field QC samples.

3.3.1 Trip Blanks

Twelve trip blanks were prepared and analyzed by Compuchem Laboratory in North Carolina and Pace Laboratories in New York. The blanks were prepared in the labs using ASTM Type II water. The trip blanks were stored with the unused sample bottles and returned to the laboratory with each cooler containing environmental samples to be analyzed for VOCs. Methylene chloride was detected at concentrations greater than the contract required quantitation limit (CRQL) in three trip blanks C-TB4, C-TB5, and C-TB12. Table F-12 of Appendix F summarizes the concentrations of the VOCs detected in the trip blanks collected during the SI field effort.

3.3.2 Field Blanks

Six field blanks were collected to provide baseline analytical data for the water used for equipment decontamination. Field blanks were taken for the ASTM Type II water used and the potable water used in the steam cleaner and as decontamination water. Field blanks were collected by randomly selecting sample containers from the supply, filling them with water from the sample source, and then preserving as appropriate for the required analysis.

The blanks were analyzed in the same manner as the associated environmental samples. Concentrations of chloroform, brominated compounds, lead, arsenic, nickel, and chromium were detected in selected field blanks prepared during the SI. Table F-12 of Appendix F summarizes the concentrations of elements detected in the field blanks collected at Capital ANG. The ILANG, Capital Airport SI was conducted in two sampling events. Therefore, separate field blanks were obtained for each sampling event. The low concentrations of compounds and elements detected in the field blanks are not considered to have contributed to concentrations seen in the associated environmental samples, with the possible exception of the detections of lead (3.5 µg/l and 35.7 µg/l) and arsenic (2.1 µg/l and 43.7 µg/l) in C-FB4 and C-FB6, respectively.

3.3.3 Equipment Rinseates

Six equipment rinseates were prepared from rinseates of equipment used to obtain environmental samples. The equipment rinseates were prepared by pouring ASTM Type II water through or over sampling equipment which had been decontaminated. The equipment rinseates were preserved as appropriate for the required analysis and analyzed using the same methods as the associated environmental samples. Lead was detected above the method detection limit in one equipment rinseate, C-ER1, collected during the SI. VOCs were detected at low concentrations in the equipment rinseates. C-ER10 contained toluene and C-ER1 contained 2-propanone (acetone). No SVOCs or PCB/pesticides were detected in equipment rinseates. Table F-12 of Appendix H summarizes the concentrations of elements detected in the equipment rinseates collected at Capital ANG Base.

3.3.4 Field Replicates

One replicate environmental sample was collected for every 10 environmental samples, as required by DOE/HWP-65/R1. Sample collection reproducibility and media variability were measured in the laboratory by the analysis of field replicates. Field RPD values were calculated for all compounds and elements detected above the CRDLs in one or both of the replicate pair samples. The RPD value of the detected compound or parameter was reviewed to assess the sample collection reproducibility and matrix variability. A total of 37 soil samples, 17 water samples, 3 sediment samples, four soil replicate samples and two duplicate water samples were collected.

Increased percent differences were expected for all analytes detected in soil samples, since all samples remained in stainless sleeves (i.e., not mixed) after the sampling equipment was retrieved from the borehole. The field replicate for each soil analyses was obtained from the adjacent sleeve and water samples were split into different sample containers upon sampling. Two of 2 soil RPD values calculated exceeded the 35% control limit. One of 1 water RPD value calculated for VOCs were greater than 20%. The RPDs values that exceeded the 35% ranged from 38% to 67%. One of 4 soil RPD values calculated for SVOCs exceeded 35% limit. The SVOC outlier reported a RPD value of 59%. There were no SVOCs detected above the CRDL in the sample duplicate pair. Twenty-two of the 52 soil RPD calculated for metals were greater than 35%. The RPDs that exceeded the 35% limit ranged between 43% to 200%. Eleven of the 21 water RPD values

calculated for metals were greater than 20%. The RPDs that exceeded the 20% limit ranged from 43% to 199%. Five soil RPD values were calculated for pesticides/PCBs. All of the calculated values exceeded the control limit of 35%. The RPDs ranged from 103% to 171%. All the pesticides/PCBs values were calculated from one sample/duplicated pair (CF-SB2-SS0.5-1 and CF-SB4-SS0.5-1). Overall these results indicate that 42 of the 85 RPD values calculated from the sample/duplicate pairs exceeded their respective control limits of 35% for soil samples and 20% for aqueous samples. This is considered to have had some impact on the environmental data quality but may be the result of the variability of the soil matrix. Table F-13 of Appendix F summarizes the concentrations of elements detected in the replicate environmental samples collected at the ILANG, Capital Airport.

3.4 LABORATORY QUALITY CONTROL ASSESSMENT

All environmental samples collected at Capital ANG Base were analyzed using the 3/90 EPA CLP SOW for GC/MS analyses and EPA solid waste test methods and general chemical methodology from the following references:

- *SOW For Organics Analysis, Multi-Media, Multi-Concentration*, EPA CLP, 3/90, OLM01.8 (SVOCs and pesticides/PCBs)
- *SOW for Inorganics Analysis, Multi-Media, Multi-Concentration*, EPA CLP, 3/90, ILM02.1 (TAL metals)
- *Test Methods for Evaluating Solid Waste, Physical/ Chemical Methods*, SW-846, Third Edition, September 1986, with 1989 revisions (VOCs)
- *Requirements for QC of Analytical Data*, HAZWRAP, DOE/HWP-65/R1 6/90 (VOCs)

HAZWRAP Level C documentation was required and submitted by the laboratory for all analyses. All data were validated and qualified using the guidelines and specifications described in the following documents:

- *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses*, EPA Contract Laboratory Program, June 1991, (Region III modifications. June 1992) (SVOCs/Pesticides/PCBs)
- *Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses*, EPA Contract Laboratory Program, February 1988 (TAL metals)
- *Requirements for QC of Analytical Data*, Hazardous Waste Remedial Actions Program (DOE/HWP-65/R1), July 1990 (VOCs)

All data validation qualifiers used were applied to the data as required by the forementioned guidelines. EPA Region III data validation guidelines were utilized, to enable usage of additional data qualifiers (B, K, and L) not available from current EPA Region V guidelines. A complete summary of all data obtained and the qualifiers applied to that data is presented in Appendix G.

3.5 BACKGROUND SOILS SAMPLING

Background surface and subsurface soil samples were collected on base property using a stainless steel hand-auger. Surface soil samples were collected from 0 to 1.0 ft bgs, and subsurface soil samples were collected from 2.5 to 3.0 ft bgs. These data were used to determine concentrations of inorganics in the native or undisturbed soils on base. Up-gradient monitoring wells were installed and sampled for inorganics at each site. Inorganic concentrations from these wells were used as the site-specific background for groundwater. The base-wide soils and up-gradient groundwater analyses can then be compared to site specific concentrations of inorganics. By comparing the two data sets, an indication of whether past releases of hazardous materials to the environment have resulted in elevated concentrations of inorganics in the soils or groundwater. No sediment or surface water samples were collected for background determination.

During December 1992 surface and subsurface soil samples were collected at Sites 1 and 2 for use in determining site-specific background concentrations. These initial background samples were obtained at locations SB108, SS101, and SS102 in Site 1 (Figure 3-3) and at locations SB204, SS201, and SS202 in Site 2 (Figure 3-12). Numerous SVOCs, particularly polynuclear aromatic hydrocarbons (PAHs) were detected in these soil samples. Because the analytical results revealed the presence of SVOCs, it was determined that these samples were likely not representative of background conditions and the results were rejected for use as background data.

In April 1993 additional background soil samples were collected from locations along the eastern portion of the facility, away from Sites 1 and 2. According to BCE personnel, the areas had been undisturbed by construction activities and had no history of being used as waste storage or handling areas. The results from this sampling were used as preliminary background soils data for both Sites 1 and 2. Figure 3-1 presents the facility background soil sampling locations CF-SB1, CF-SB2, and CF-SB3. Two soil samples, one surface and one subsurface sample were collected from each location. Additionally, a blind duplicate surface soil sample was collected from boring CF-SB2, and labeled CF-SB4.

Background soil samples were collected according to procedures described in Section 2.4.2.2 and were analyzed for VOCs, SVOCs, pesticides/PCBs, and TAL metals. The analytical results for the surface and subsurface samples are presented in Tables 3-12 and 3-13, respectively. In general, the soils were described as brown to grey-brown colored silty clays. Soil sampling forms are included in Appendix H.

Table 3-12 presents concentrations of detected VOCs, SVOCs, TAL metals, and pesticides from background surface soil samples. Table 3-13 presents concentrations of detected VOCs, SVOCs, and TAL metals from background subsurface soil samples. No PCBs were detected in either surface or subsurface soil samples. Two VOCs, chloroform (one detection in a surface soil sample; 1 $\mu\text{g/kg}$) and 2-propanone (acetone) (seven detections in both surface and subsurface soil samples; 14J to 210 J $\mu\text{g/kg}$) were found in the background soil samples. Seven SVOCs were detected, and consisted of the following PAHs: 2,2' - oxbis (1-Chloropropane) (one detection; 74 mg/kg), benzo (b) fluoranthene (two detections; 77 and 96 mg/kg), chrysene (two detections; 54 and 56 mg/kg), fluoranthene (two detections; 110 to 120 mg/kg), phenanthrene (two detections; 51 and 55 mg/kg), pyrene (two detections; 95 and 100 mg/kg); and bis (2-ethylhexyl) phthalate (seven detections; 120 to 180 mg/kg). Detections of SVOCs in subsurface soil samples were limited to three detections of bis (2-ethylhexyl) phthalate. Pesticides, including heptachlor, heptachlor epoxide, dieldrin, methoxychlor, alpha -and gamma -chlordane were detected in the surface soils only, at relatively low concentrations (0.23 to 260 $\mu\text{g/kg}$). The pesticide compounds may have been used across the base for weed or insect control. Many of the VOCs and SVOCs such as 2-propanone (acetone),

**Table 3-12 Data Summary Table: Surface Soil - Facility Background
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator:
Sample ID:
Collection Date:
Associated Field QC Samples:

UNITS	CF-SB1 CF-SB1-SSO-1 04/19/93 FB5,FB6,TB32,ER11	CF-SB2 CF-SB2-SSO.5-1 04/19/93 FB5,FB6,TB32,ER11	CF-SB3 CF-SB3-SSO.5-1 04/19/93 FB5,FB6,TB32,ER11	CF-SB4 CF-SB4-SSO.5-1* 04/19/93 FB5,FB6,TB32,ER11
	RESULT	QUAL	RESULT	QUAL
VOCs				
2-Propanone	40	J	17	J
Chloroform	6	U	6	U
SVOCs				
2,2'-Oxybis(1-Chloropropane)	400	U	400	U
Benzo(b)fluoranthene	77		96	U
Benzo(k)fluoranthene	77		96	U
Chrysene	54		56	U
Fluoranthene	120		110	U
Phenanthrene	51		55	U
Pyrene	95		100	U
bis(2-Ethylhexyl)phthalate	150		180	J
METALS				
Aluminum	11500		14500	
Arsenic	8.1	L	8.6	L
Barium	111		78.1	
Beryllium	0.49	U	0.56	
Calcium	3480		1910	
Chromium	14.7		27.8	
Cobalt	6.3		10.8	
Copper	12.3		27.7	
Iron	14200		36000	
Lead	15.1	J	14.6	J
Magnesium	2520		2940	
Manganese	617	J	352	J
Nickel	12		23.3	
Potassium	1600	J	1210	
Vanadium	27.3		41.5	
Zinc	48.8		61.9	

Only those analytes detected in one or more samples are shown

() Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

L Concentration or quantitation limit is biased low
R Data is unreliable
U Compound was analyzed for but not detected
* Field Replicate of CF-SB2-SSO.5-1

Lab: COMPUCHEM

**Table 3-12 Data Summary Table: Surface Soil - Facility Background
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator:

Sample ID:

Collection Date:

Associated Field QC Samples:

UNITS

	CF-SB1		CF-SB2		CF-SB3		CF-SB4	
	CF-SB1-SS0.5-1	CF-SB2-SS0.5-1	CF-SB3-SS0.5-1	CF-SB4-SS0.5-1*				
	04/19/93	04/19/93	04/19/93	04/19/93				
	FB5,FB6,TB32,ER11	FB5,FB6,TB32,ER11	FB5,FB6,TB32,ER11	FB5,FB6,TB32,ER11				
UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
Pesticides/PCBs								
Dieldrin	150		260		0.66		59	
Heptachlor	10	U	1		0.23		0.32	
Heptachlor epoxide	10	U	57		2.1	U	17	
Methoxychlor	100	U	100	U	1.3		21	U
alpha-Chlordane	1		9.9		2.1	U	1.1	
gamma-Chlordane	10	U	29		2.1	U	2.3	

Only those analytes detected in one or more samples are shown

I) Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

* Field Replicate of CF-SB2-SS0.5-1

Lab: COMPUCEM

**Table 3-13 Data Summary Table: Subsurface Soil - Facility Background
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator: CF-SB1 CF-SB2 CF-SB3
Sample ID: CF-SB1-SS2.5-3 CF-SB2-SS2.5-3 CF-SB3-SS2.5-3
Collection Date: 04/19/93 04/19/93 04/19/93
Associated Field QC Samples: FB5,FB6,TB32,ER1 FB5,FB6,TB32,ER11 FB5,FB6,TB32,ER11
UNITS RESULT QUAL RESULT QUAL RESULT QUAL

VOCs						
2-Propanone	ug/kg	120	J	44	B	210
						B
SVOCs						
bis(2-Ethylhexyl)phthalate	ug/kg	120		130	J	160
						J
METALS						
Aluminum	mg/kg	3520		16800		18300
Arsenic	mg/kg	2.1	0	13.8	L	14.3
Barium	mg/kg	15.8	0	235		114
Beryllium	mg/kg	0.50	U	1	0	0.62
Calcium	mg/kg	534	0	3060		2500
Chromium	mg/kg	4.2		18.8		23.1
Cobalt	mg/kg	2.3	U	17		6.2
Copper	mg/kg	6.5		17.3		17.5
Iron	mg/kg	4050		26500		22100
Lead	mg/kg	2.8	J	28.2	J	16.3
Magnesium	mg/kg	699	0	3210		3810
Manganese	mg/kg	32.2	J	2100	J	263
Nickel	mg/kg	7.8	J	25.8		17.2
Potassium	mg/kg	561	U	1230	0	1510
Vanadium	mg/kg	9.3	0	37.5		35.5
Zinc	mg/kg	15.4		58.3		54.3

Only those analytes detected in one or more samples are shown

0 Value is between IDL and the CRDL
B Compound or analyte detected in field or lab blank
J Concentration is estimated
K Concentration or quantitation limit is biased high

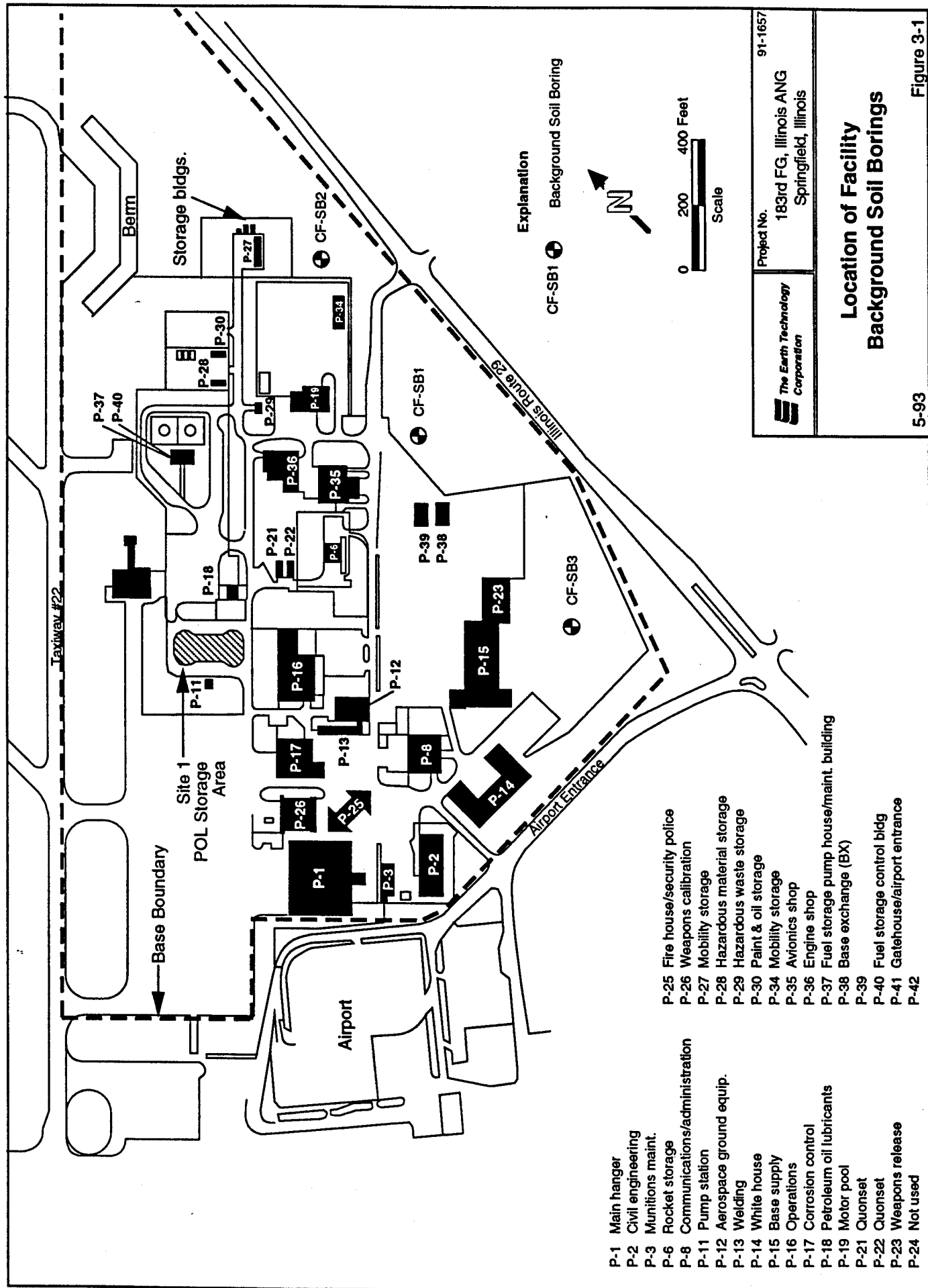
L

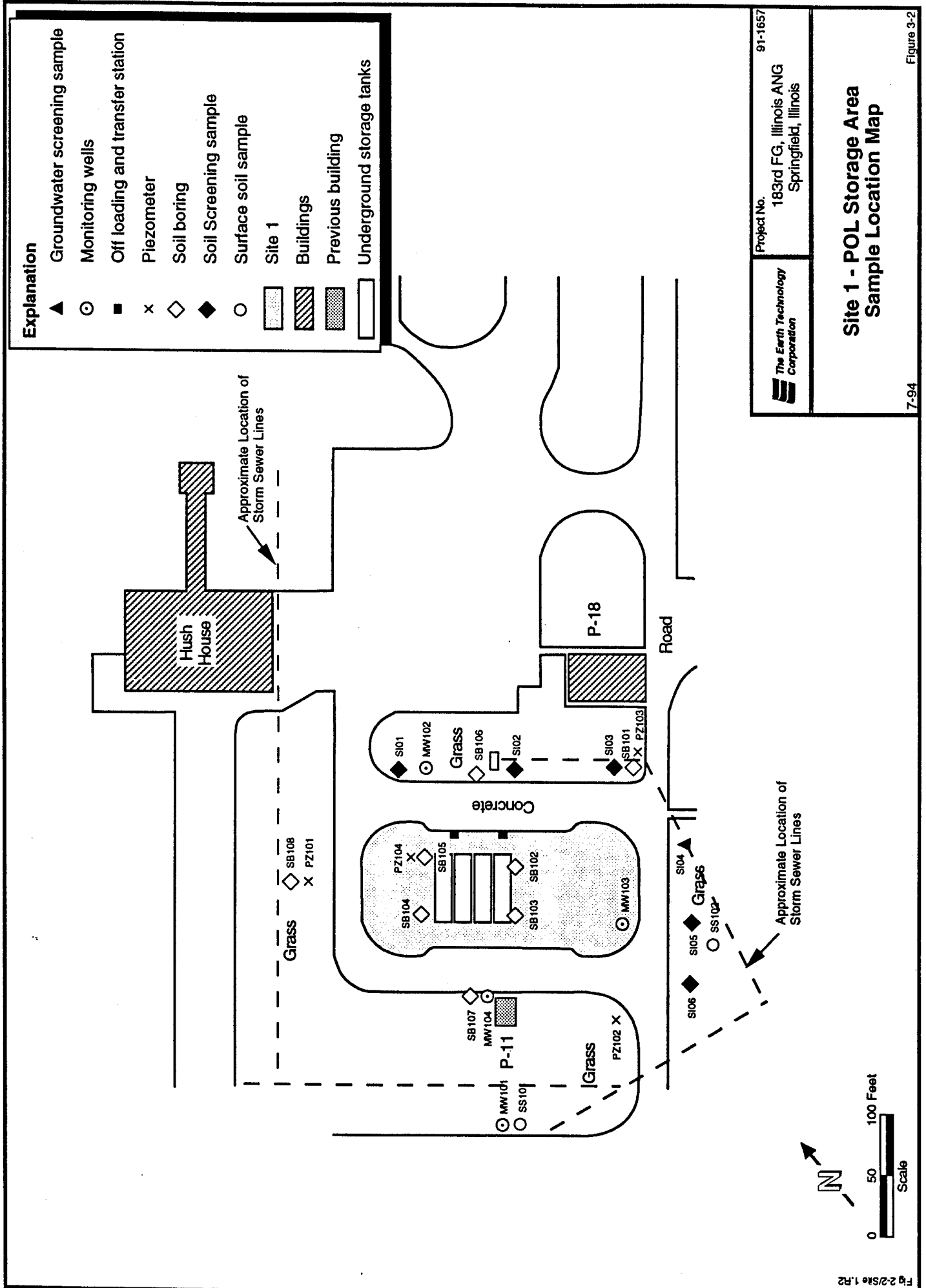
R

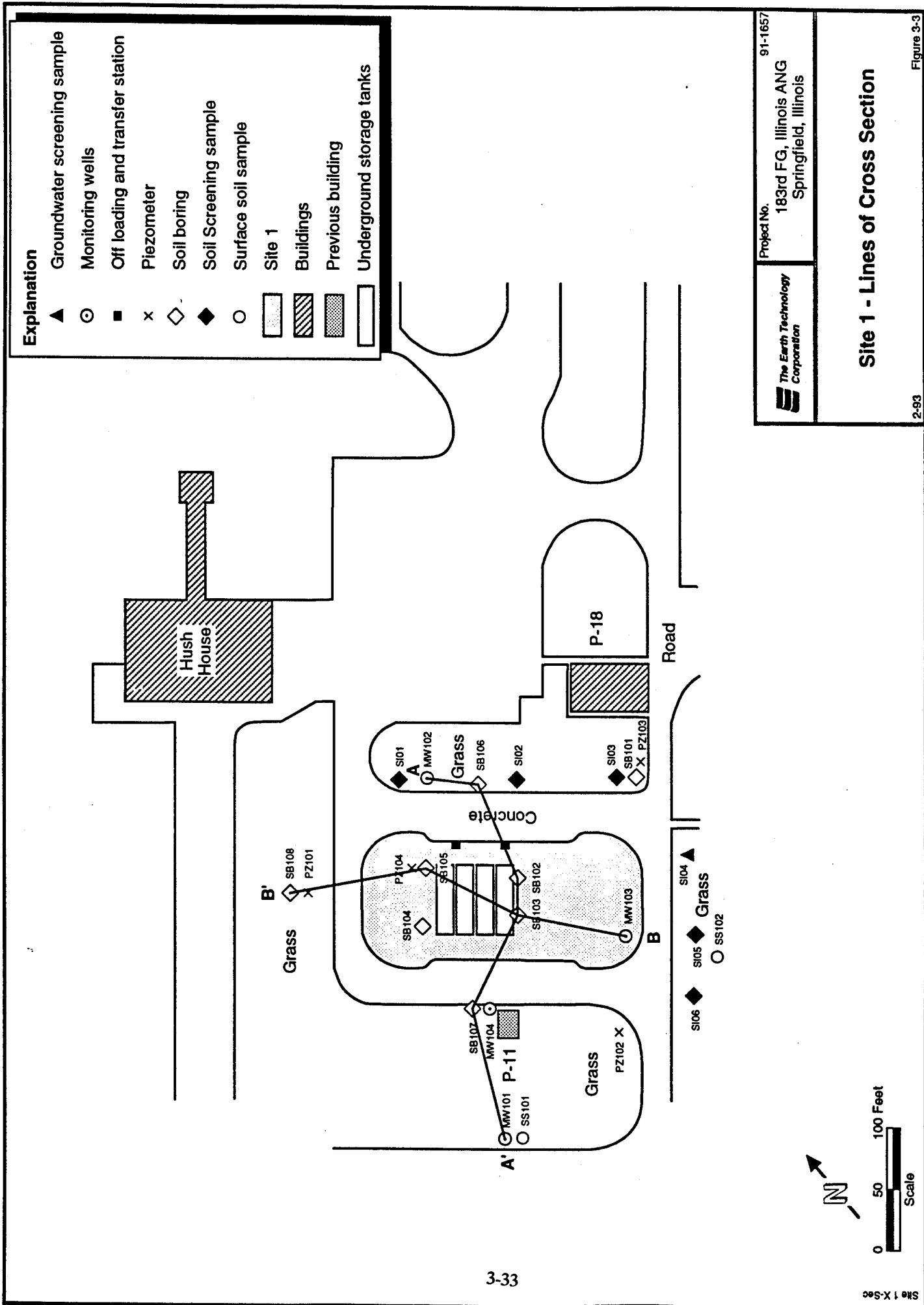
U

Concentration or quantitation limit is biased low
Data is unreliable
Compound was analyzed for but not detected

Lab: COMPUCHEM







chloroform, and the phthalate esters are considered common laboratory contaminants. Detections of other SVOCs are possibly due to area-specific conditions. Therefore, the detection of organic compounds in these background soil samples are not considered completely representative of site-wide background concentrations.

In addition to the organic compounds listed above, concentrations of TAL metals were detected in the soils. The ranges of TAL metal concentrations, assumed to be representative of background concentrations, were used as background values, for comparison with site specific TAL metal concentrations.

3.6 SITE 1: POL STORAGE AREA

The following investigation activities were performed at Site 1 (sample totals include QA/QC duplicates, if applicable):

- 9 grab samples (8 soil and 1 groundwater) were collected using a Geoprobe unit and analyzed with a field GC.
- 13 boreholes were drilled at the site.
 - 5 of these boreholes were completed as soil-borings,
 - 4 of these boreholes were completed as monitoring wells,
 - 4 of these boreholes were completed as piezometers.
- 30 soil samples were collected and screened for selected VOCs using a field GC.
- 17 soil samples (including surface soil samples) were collected and shipped to a fixed-base laboratory for analysis of VOCs, SVOCs, and lead. Two surface soil samples were analyzed for pesticides and PCBs.
- 1 soil sample was collected and analyzed for the geotechnical parameters listed in Section 2.
- 8 groundwater samples were collected and shipped to a fixed-base laboratory for analysis of VOCs, SVOCs, and total (unfiltered) and dissolved (filtered) lead content. Two rounds of samples were collected from four monitoring wells.
- 2 rounds of groundwater elevation measurements were collected.
- 3 aquifer slug tests were conducted in MW101, MW102, and MW104. Figure 3-2 presents a site map of the POL Storage Area illustrating the SI sampling, boring, piezometer, and monitoring well locations.

3.6.1 Site Geology and Hydrogeology

Geology

As discussed in Section 3.2, soils underlying the base are clay and silt-rich. The locations of geologic profiles A-A' and B-B' are shown in Figure 3-3. These profiles are presented as Figures 3-4

and 3-5, and were constructed based on the field observations obtained during drilling operations. As presented on the two profiles, a layer of fill, or reworked native soil has been interpreted to exist in the upper few feet of a majority of the soil borings. The fill material is generally very similar to the native clay soils. However, it was differentiated from the native soils based on the presence of man-made objects (brick fragments, nails, etc), or the occurrence of gravel in the soil. Soil boring SB106 was drilled through a sand/gravel section interpreted to be the backfill of the storm sewer line trench.

The depth of the tankpit is estimated to be approximately 8 ft bgs. Beneath the fill unit, or clay-rich native soils, a thin silt layer is present in the subsurface. The silt layer exists on the north side of the tank pit and was described only in borings SB102, SB105, SB106, and SB108. As described in boring SB101, a lower clay unit underlies the silt unit. SB101 was continuously sampled until bedrock was encountered at 21.5 ft bgs.

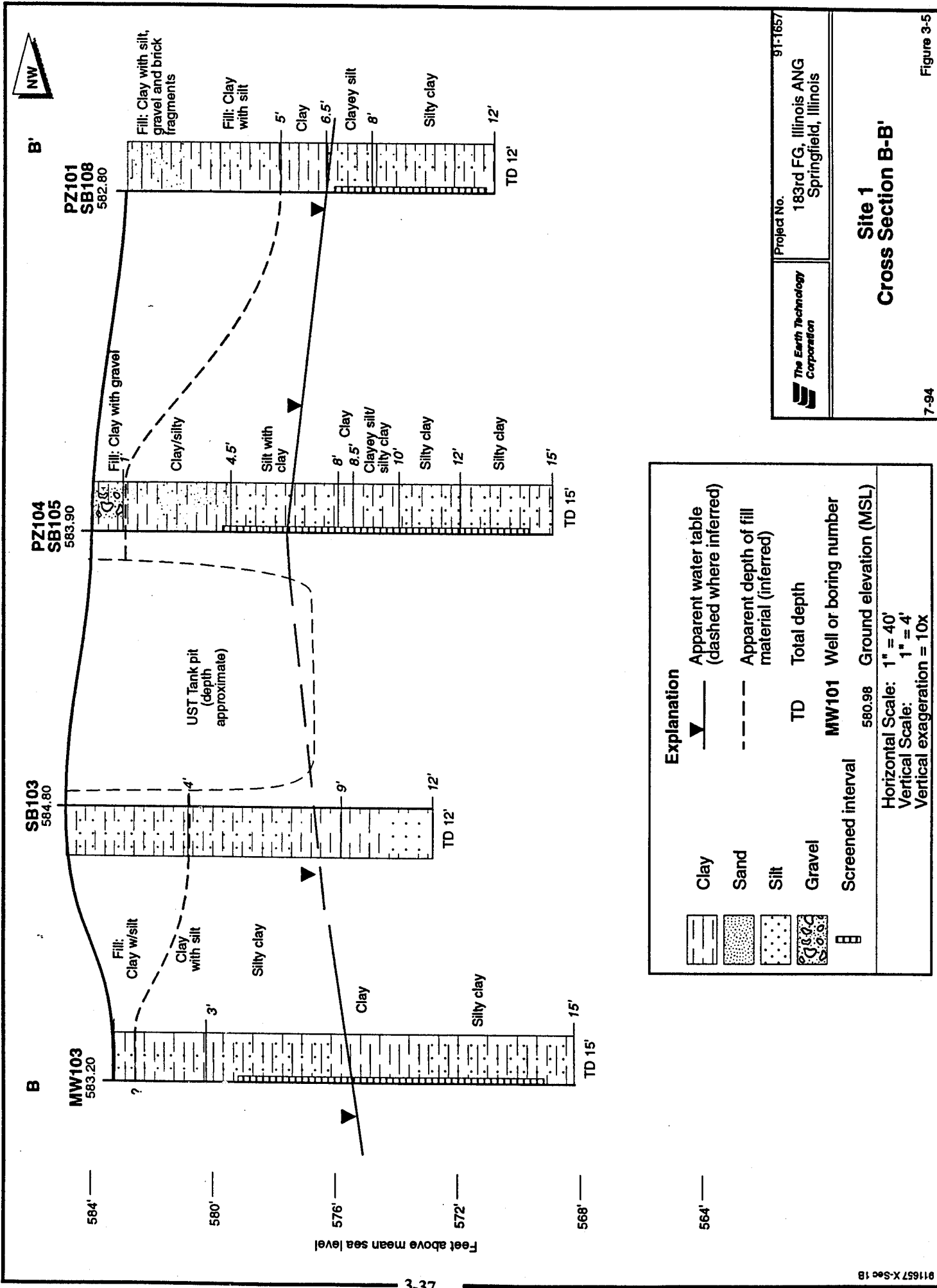
Hydrogeology

Four piezometers (PZ101, PZ102, PZ103, and PZ104) were installed during the initial round of confirmation activities (November 16 through 25, 1992) (Figure 3-2). Groundwater elevation measurements were obtained from these piezometers on November 24, 1992 and used in combination with the well top survey data to create groundwater elevation maps. These elevation data are included in Table 3-2. Up-gradient and down-gradient monitoring wells (MW101, MW102, MW103, and MW104) were installed based on these data (Figure 3-2). After the installation of the monitoring wells, groundwater elevation measurements were obtained again on December 7, 1992 and April 12, 1993. By comparison, the November and December 1992, and April 1993 measurements show little variation. Therefore, a groundwater elevation contour map was created for Site 1 based on April 12, 1993 data only. The measurements indicate relatively stable groundwater concentrations. This map is presented as Figure 3-6. As shown on Figure 3-6 groundwater flow is generally to the southwest at an average hydraulic gradient of 0.0182. This gradient was determined based on the change in groundwater elevation from MW102 to MW101. As is also illustrated in Figure 3-6, MW102 is located up-gradient of the tank pit, while MW101, MW104, and MW103 are located in the down-gradient direction.

Hydraulic conductivity (K) measurements and groundwater velocities were calculated per well, based on data generated from falling and rising head slug tests. Slug test derived K values range from 4.83×10^{-5} to 2.94×10^{-4} cm/sec. The average K for Site 1 is 1.35×10^{-4} cm/sec. Average groundwater velocity and aquifer transmissivity, calculated by the methods described in Section 3.1.2, are 4.32 ft/year and $0.0823 \text{ cm}^2/\text{sec}$, respectively.

Site 1 aquifer slug test data are presented in the following table.

Well Number	Average Hydraulic Conductivity (k-cm/sec)	Groundwater velocity (ft/year)
MW 101	4.83×10^{-5}	1.5 ft/year
MW 103	6.21×10^{-5}	1.96 ft/year
MW 104	2.94×10^{-4}	9.52 ft/year
Site 1 Average	1.35×10^{-4}	4.32 ft/year

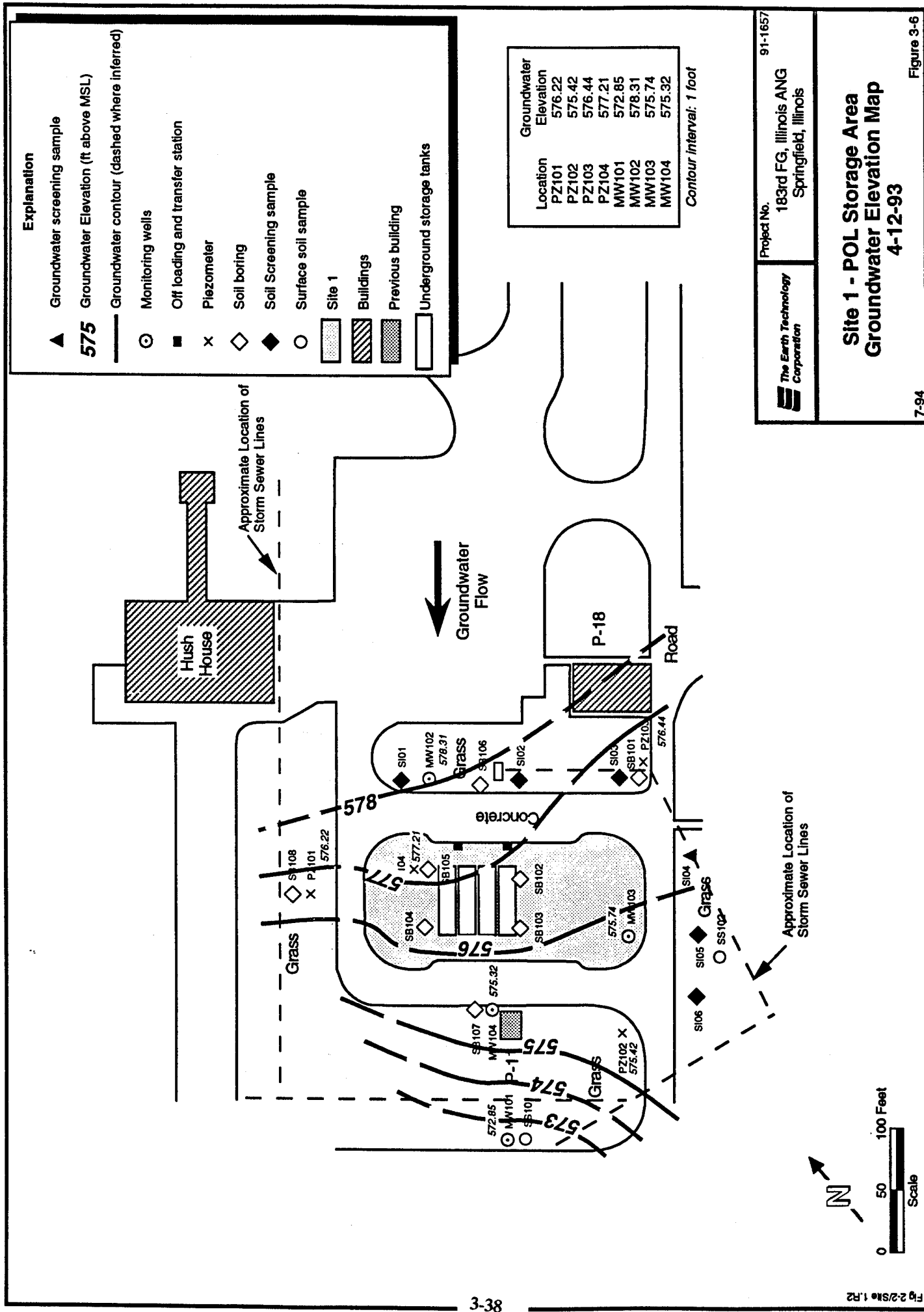


The Earth Technology Corporation

Project No. 91-1657

183rd FG, Illinois ANG
Springfield, Illinois

Site 1
Cross Section B-B'



The Earth Technology Corporation

Project No. 91-1657

183rd FG, Illinois ANG

Springfield, Illinois

Site 1 - POL Storage Area

Groundwater Elevation Map

4-12-93

Figure 3-6

7-94

Piezometer PZ104 was installed on the northwest corner of the tank pit to determine if free-phase, floating JP-4 fuel exists at the site. Results obtained from placing an electronic hydrocarbon water interface probe in PZ104 indicated no free phase product exists in this piezometer.

3.6.2 Screening Activity Results

Screening activity results include the SOV survey performed in 1991 by Patrick Engineering, the soil and groundwater screening survey performed by Burlington Environmental, Inc., and the field GC screening of soil samples collected during the soil boring program.

In February 1991 Patrick Engineering completed an SOV survey at Site 1 of the area surrounding the tank pit. Their report "Soil Organic Vapor Survey of Fuel Tank Farms" (Patrick Engineering, March 1991) concluded that JP-4 fuel contamination of soil and groundwater is probable at the site. The Patrick Engineering SOV survey consisted of the installation of 12 sampling points and analyzing of 12 samples for BETX and TPH. Concentrations of BETX ranged from 33 $\mu\text{g}/\ell$ to 0.8 $\mu\text{g}/\ell$. The Patrick Engineering survey did not analyze groundwater samples to determine the presence of groundwater contamination. The 1992 screening activities were designed to supplement the Patrick Engineering study.

3.6.2.1 Grab-Type Soil and Groundwater Screening Results

Soil and groundwater grab samples were collected and analyzed by Burlington Environmental, Inc. during the initial stages of this investigation using a Geoprobe unit and field GC. The soil and groundwater sampling locations are presented on Figure 3-2. Samples were collected from a total of six probehole locations at Site 1. Eight soil samples were collected from five locations, and one groundwater sample was collected. The complete data set is included in Appendix D of this report.

As discussed in Section 1.3.2.1, fuel from a spill occurring in the late 1950's was washed into the storm drains surrounding Site 1. Therefore, the soil and groundwater screening samples were collected near the storm sewer lines existing around the perimeter of the site to check for the presence of residual hydrocarbons in the storm sewer trench system. No VOCs were detected in the screening samples collected from sampling locations S101 through S105. Minor amounts of total 1,2-DCE (17 $\mu\text{g}/\text{L}$) and TVOCs (4 $\mu\text{g}/\text{L}$) were detected in the soil sample collected from 9 to 11 ft from location S106. These screening data suggest past spills have not significantly contaminated soils and groundwater around the storm sewer lines.

Soil Boring Placement Rationale

Because of the lack of VOCs detected in the screening samples, soil borings were located at the four corners of the tank pit (SB102 through SB105) and in front of the refueling areas (SB106 and SB107) (Figure 3-2). These locations were selected to provide supporting data for the eventual removal of the tanks. As mentioned previously, SB101 was continuously sampled to bedrock to provide lithologic descriptions of the shallow soils and aquifer underlying the site.

3.6.2.2 Field GC Screening Results

During the drilling and sampling of soil borings SB101 through SB108 and piezometer PZ102, soil samples were collected and analyzed in the field for selected VOCs by the methods described in Section 2.3.2 of this report. Field GC results and chromatograms are presented in Appendix E.

Table 3-14 summarizes the field GC analytical results, per analyte.

Table 3-14 Field GC Analytical Results - Site 1 POL Storage Area
ILANG, Capital Airport, Springfield, Illinois

Analyte	# of Positive Detections ^a / # of Samples	Range of Concentrations (in $\mu\text{g}/\ell$ of air)
Benzene	2/33	ND - 3
Toluene	12/33	ND - 6,060
Ethylbenzene	13/33	ND - 11,052
Xylene (total)	14/33	ND - 27,780
total BTEX	16/33	ND - 44,208
Dichloroethene	0/33	ND
Trichloroethene	11/33	ND - 8,610
Tetrachloroethene	12/33	ND - 13,306

ND Not Detected
^a Does not include samples quantified as Below Measurable Detection Limits

Field GC results are comparable to fixed-base data in the vadose zone. The field GC generally indicates higher concentrations of detected compounds than the fixed-base analytical. The field GC data was not used to define the contamination present at the site, but rather to provide a means of comparing relative concentrations of contaminants in the field. No fixed-base data was collected from the saturated zone. Field GC screening was performed in the saturated zone as an indicator of groundwater contamination. These results indicate possible VOC contamination of the groundwater rather than the soils and should not be compared with the data obtained from the vadose zone soil samples.

The data presented Table 3-14 indicate benzene was detected in only two samples collected from Site 1 at a maximum concentration of 3 $\mu\text{g}/\text{L}$ of air. In contrast, the remaining BTEX compounds were detected more frequently and at significantly greater concentrations than benzene. Total BTEX was detected in 16 of 33 samples at a maximum concentration of 44,208 $\mu\text{g}/\text{L}$ of air. Of the 16 samples that tested positively for one or more of the BTEX compounds, 10 of those samples were collected from depths in the subsurface at or below the water table. The lateral and vertical distribution of hydrocarbons in the subsurface, as shown by the field GC screening data, are discussed in Section 3.7.2.2. In addition to the BTEX group of compounds, the chlorinated hydrocarbons TCE and PCE were detected in approximately one-third of the samples at maximum concentrations of 8,610 and 13,306 $\mu\text{g}/\text{L}$ of air, respectively. However, at elevated concentrations of petroleum hydrocarbons, the quantitative capabilities of field GC analysis are limited, and it is difficult to distinguish some petroleum peaks, such as those similar to TCE and PCE. Considering JP-4 jet fuel is not known to contain either TCE or PCE, it is possible these GC peaks are attributable to other petroleum hydrocarbons typical of JP-4 mixtures.

3.6.3 Confirmation and Delineation Results

Selected surface and subsurface soil and groundwater samples were collected and analyzed by Pace Laboratories for VOCs, SVOCs and lead. All analytical results for soils are presented in micrograms per kilogram ($\mu\text{g}/\text{kg}$) for organic compounds or milligrams per kilogram (mg/kg) for inorganic compounds. For groundwater samples, all results for both organic and inorganic

compounds are reported in $\mu\text{g/L}$. A discussion of the analytical results obtained from the samples collected and analyzed during the investigation is included in the following sections. Many of the organic compounds detected at the sites occur as members of a group of compounds. Where practical, discussions regarding the occurrence of the families of chemicals has been chosen over the occurrence of specific chemicals. For example, if BTEX occur at a site in concentrations of 100 $\mu\text{g/kg}$ each, the discussion in the text will state total BTEX of 400 $\mu\text{g/kg}$ occurring at the site. The following lists the specific compounds included in each of the chemical groups referred to in the text.

POLYNUCLEAR AROMATIC HYDROCARBONS (PAHS)

Acenaphthene	Chrysene
Acenaphthylene	Dibenzo (a,h) anthracene
Anthracene	Fluoranthene
Benzo (a) anthracene	Fluorene
Benzo (b) fluoranthene	Indeno (1,2,3-cd) pyrene
Benzo (k) fluoranthene	2-Methylnaphthalene
Benzo (g,h,i) perylene	Naphthalene
Benzo (a) pyrene	Phenanthrene
2-Chloronaphthalene	Pyrene

PHTHALATE ESTERS

Butylbenzylphthalate	Dimethylphthalate
Di-n-butylphthalate	Di-n-octylphthalate
Diethylphthalate	bis-2-Ethylhexyl phthalate

BTEX

Benzene	Toluene
Ethylbenzene	Xylene

Soil samples collected at Site 1 were numbered as follows, for example, sample number CS1-SB1-5-5.5 refers to Capital Site (CS1) 1, SB1 refers to soil boring SB101, and 5-5.5 indicates the depth in feet bgs that the soil sample was collected from. Portions of the text and figures refer to, for example, soil samples collected from location SB101. The reader should be aware that SB101 is equivalent to CS1-SB1 on the analytical data tables. Groundwater samples were numbered in a similar manner.

3.6.3.1 Surface Soil Samples

Nine surface soil samples were collected from sampling locations SB102 through SB108 and from SS101 and SS102 (Figure 3-2). Fixed-base soil samples were not obtained from SB101, PZ102, and the monitoring well locations. The surface soil analytical results are presented in Table 3-15. Figure 3-7 presents a summary of the analytical results for each surface soil sampling location.

Volatile Organic Compounds

Methylene chloride was detected in surface soil sample SS101 at a concentration of 13 $\mu\text{g/kg}$. Methylene chloride commonly occurs as a laboratory cross-contaminant. Other than the methylene chloride detection, no BTEX or other VOC detections were noted in surface soil samples from Site 1. The lack of VOCs detected in the vadose zone surface soils is supported by the low field PID readings obtained during drilling (see boring logs - Appendix C) and the absence of VOCs in the field GC analysis (Appendix E).

Table 3-15 Data Summary Table: Surface Soils - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois

LOCATOR:
SAMPLE ID:
COLLECTION DATE:
ASSOCIATED FIELD QC:

SB102 SB103 SB104 SB104 SB105
CS1-SB2-05-1 CS1-SB3-0-05 CS1-SB4-0-05 CS1-SB4-05-1* CS1-SB5-025
11/18/92 11/18/92 11/18/92 11/18/92 11/18/92
TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1

UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
TYPE A Soil Cleanup Objectives										
VOCS										
Methylene chloride	6	B	6	B	4	B	6	B	6	B
Xylenes (TOTAL)	6	U	6	U	6	U	6	U	9	U
SVOCs										
1,4-Dichlorobenzene	400	U	410	U	97	U	53	U	48	U
Acenaphthene	400	U	410	U	410	U	400	U	410	U
Acenaphthylene	400	U	410	U	410	U	400	U	410	U
Anthracene	400	U	410	U	410	U	400	U	410	U
Benzo(a)anthracene	400	U	410	U	29	U	400	U	23	U
Benzo(a)pyrene	400	U	410	U	49	U	400	U	24	U
Benzo(b)fluoranthene	400	U	410	U	130	U	400	U	410	U
Benzo(g,h,i)perylene	400	U	410	U	45	U	400	U	410	U
Benzo(k)fluoranthene	400	U	410	U	410	U	400	U	410	U
Butyl benzyl phthalate	400	U	410	U	410	U	400	U	410	U
Carbazole	400	U	410	U	410	U	400	U	410	U
Chrysene	400	U	410	U	65	U	400	U	38	U
Di-n-butyl phthalate	400	U	24	J	30	J	30	U	27	U
Diethyl phthalate	44	U	67	J	130	J	170	U	34	U
Fluoranthene	30	U	410	U	54	U	400	U	55	U
Fluorene	400	U	410	U	410	U	400	U	410	U
Indeno(1,2,3-c,d)pyrene	400	U	410	U	83	U	400	U	410	U
Phenanthrene	400	U	410	U	410	U	400	U	32	U
Pyrene	400	U	410	U	48	U	400	U	41	U
bis(2-Ethylhexyl)phthalate	77	B	79	J	47	B	120	B	52	B

¹Type A soil cleanup objective of 4200 ug/kg is total concentration for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.

²Type A soil cleanup objective for lead is 7.5 ug/L (TCCLP).

Only those analytes detected in one or more samples are shown

U Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

- Analysis not performed

L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

* Field Replicate of CS1-SB4-0-05

Lab: COMPUCHEM

**Table 3-15 Data Summary Table: Surface Soils - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

LOCATOR:
SAMPLE ID:
COLLECTION DATE:
ASSOCIATED FIELD QC:

	SB102		SB103		SB104		SB104		SB105	
	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
	CS1-SB2-05-1	11/18/92	CS1-SB3-0-05	11/18/92	CS1-SB4-0-05	11/18/92	CS1-SB4-05-1*	11/18/92	CS1-SB5-025	11/18/92
	TB1,FB1,FB2,ER1		TB1,FB1,FB2,ER1		TB1,FB1,FB2,ER1		TB1,FB1,FB2,ER1		TB1,FB1,FB2,ER1	
UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL

METALS

7.5 mg/kg

17.3

L

22.5

L

27.3

L

21.1

L

16.6

L

TYPE A Soil Cleanup Objectives

PCBs/Pesticides

ug/kg

-

-

-

-

-

-

¹Type A soil cleanup objective of 4200 ug/kg is total concentration for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.
²Type A soil cleanup objective for lead is 7.5 ug/L (TCLP).

Only those analytes detected in one or more samples are shown

O Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

- Analysis not performed

L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

* Field Replicate of CS1-SB4-0-05

Lab: COMPUCHEM

**Table 3-15 Data Summary Table: Surface Soils - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

LOCATOR:
SAMPLE ID:
COLLECTION DATE:
ASSOCIATED FIELD QC:

SB106 CS1-SB6-0-05 SB107 CS1-SB7-0-05 SB108 CS1-SB8-0-05 SB101 CS1-SS1 SS102 CS1-SS2
11/18/92 11/19/92 11/20/92 12/03/92 12/03/92
TB2,FB1,FB2,ER2 TB2,FB1,FB2,ER2 TB3,FB1,FB2,ER2 TB8,FB3,FB4,ER4 TB8,FB3,FB4,ER4

VOCs	UNITS	SB106		SB107		SB108		SB101		SS102	
		RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
TYPE A Soil Cleanup Objectives											
Methylene chloride	ug/kg	2	B	6	U	6	U	13	U	4	B
Xylenes (TOTAL)	ug/kg	6	B	6	U	6	U	6	U	6	U
SVOCs											
1,4-Dichlorobenzene	ug/kg	400	U	430	U	410	U	100		64	
Acenaphthene	8400 ug/kg	400	U	430	U	410	U	24	J	410	U
Acenaphthylene	4200 ug/kg	400	U	430	U	410	U	23		410	U
Anthracene	42000 ug/kg	400	U	39		26	J	82		41	
Benzo(a)anthracene	2.6 ug/kg	400	U	210		180	J	460		410	U
Benzo(a)pyrene	4.0 ug/kg	400	UJ	270		200	J	490		27	
Benzo(b)fluoranthene	3.6 ug/kg	39	J	550		440		510		55	
Benzo(g,h,i)perylene	4200 ug/kg	37		100		410	U	140		410	U
Benzo(k)fluoranthene	3.4 ug/kg	400	U	430	U	410	U	640		33	
Butyl benzyl phthalate	ug/kg	400	U	23		410	U	400	U	410	U
Carbazole	ug/kg	400	U	42		41	J	98		410	U
Chrysene	30 ug/kg	400	U	290		270	J	610		51	
Di-n-butyl phthalate	ug/kg	400	U	50		27	B	60	B	91	B
Dibenzo(a,h)anthracene	6 ug/kg	400	U	98		410	U	190		410	U
Diethyl phthalate	ug/kg	74		70		410	U	34		28	
Fluoranthene	5600 ug/kg	400	U	410		370	J	1100		82	
Fluorene	5600 ug/kg	400	U	430	U	410	U	41		410	U
Indeno(1,2,3-c,d)pyrene	8.6 ug/kg	400	U	270	J	170	J	360		410	U
Phenanthrene	4200 ug/kg	400	U	260		240	J	550		40	
Pyrene	4200 ug/kg	400	U	410		480		970		63	
bis(2-Ethylhexyl)phthalate	ug/kg	130	B	760		48	B	320	B	240	B

¹Type A soil cleanup objective of 4200 ug/kg is total concentration for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.

²Type A soil cleanup objective for lead is 7.5 ug/L (TCLP).

Only those analytes detected in one or more samples are shown

() Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

- Analysis not performed

L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

* Field Replicate of CS1-SB4-0-05

Lab: COMPUCEM

**Table 3-15 Data Summary Table: Surface Soils - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

LOCATOR:
SAMPLE ID:
COLLECTION DATE:
ASSOCIATED FIELD QC:

	UNITS	SB106		SB107		SB108		SB101		SS102	
		RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
METALS											
Lead ²	7.5 mg/kg	21.9	L	53.9	L	30.4	L	14.9		22.1	
PCBs/Pesticides											
Methoxychlor	ug/kg	-		-		20	U	5.6		-	

TYPE A Soil Cleanup Objectives

¹Type A soil cleanup objective of 4200 ug/kg is total concentration for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.
²Type A soil cleanup objective for lead is 7.5 ug/L (TCLP).

Only those analytes detected in one or more samples are shown

() Value is between IDL and the CRDL

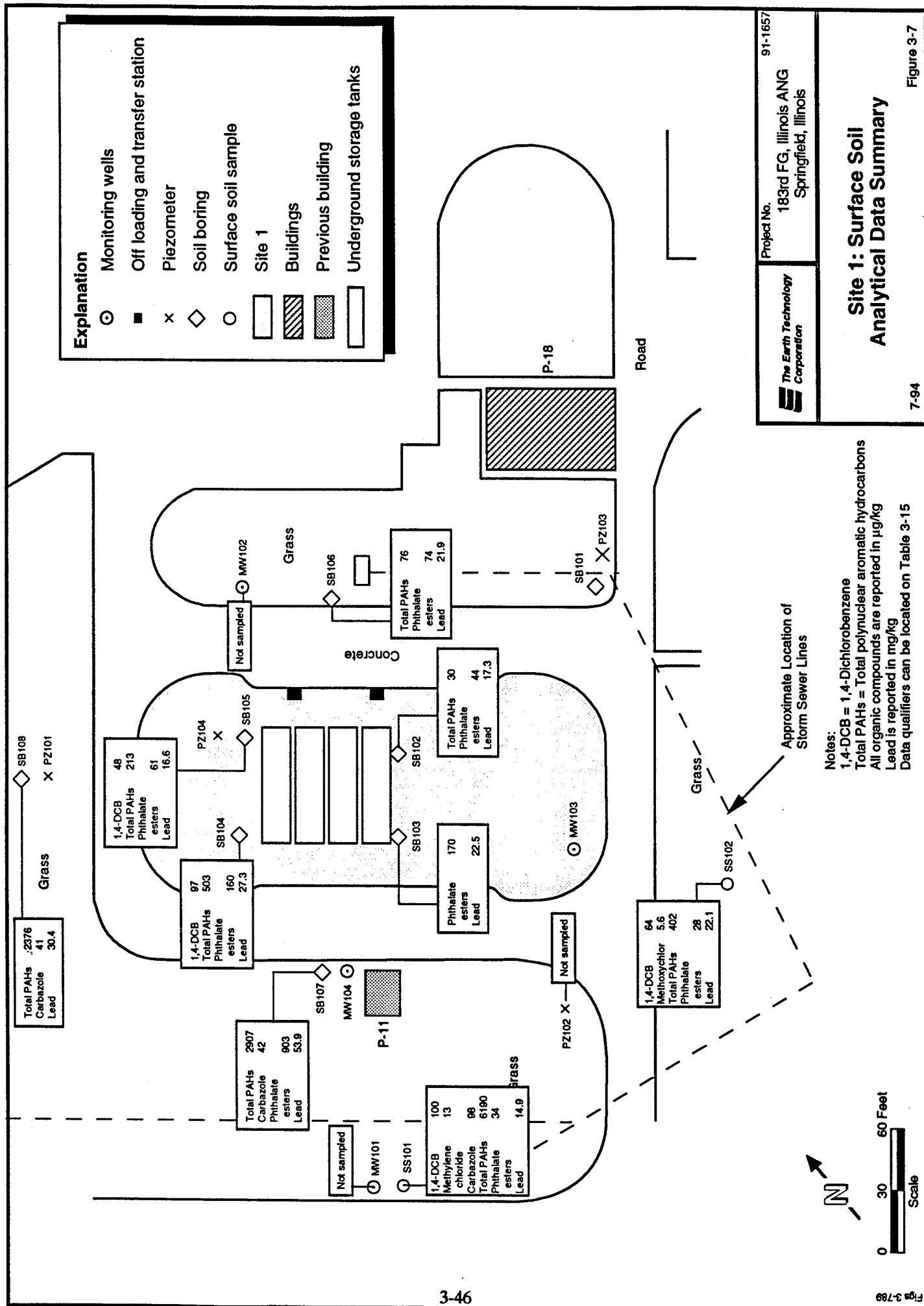
B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

- Analysis not performed
L Concentration or quantitation limit is biased low
R Data is unreliable
U Compound was analyzed for but not detected
* Field Replicate of CS1-SB4-0-05

Lab: COMPUCHEM



Semivolatile Organic Compounds

Numerous SVOCs were detected in the surface soils including compounds from the PAH and phthalate ester families, 1,4-dichlorobenzene (DCB), carbazole, and methoxychlor. As illustrated on Figure 3-7, concentrations of total PAHs range from 30 to 6,190 $\mu\text{g/kg}$ and are detected in all surface soil samples except the sample obtained from SB103. Samples collected from locations SS101, SB107, and SB108 all contained total PAHs in concentrations greater than 1,000 $\mu\text{g/kg}$. As presented on Table 3-15, a majority of individual PAH detections were less than 100 $\mu\text{g/kg}$ in magnitude. Only one compound, fluoranthene, was quantified in excess of 1 mg/kg (1000 $\mu\text{g/kg}$) at 1,100 $\mu\text{g/kg}$.

Other SVOCs detected in site surface soil samples include 1,4-DCB, (4 detections; 48 to 100 $\mu\text{g/kg}$), carbazole (2 detections; 41 to 98 $\mu\text{g/kg}$), methoxychlor (1 detection; 5.6J $\mu\text{g/kg}$) and phthalate esters (8 detections; 28 to 903 $\mu\text{g/kg}$).

Lead

Lead was found in every surface soil sample collected at the site in concentrations ranging from 14.9 to 53.9 mg/kg. The facility background concentration for lead in the surface soils ranges from 9.3 to 17.9 mg/kg. As illustrated on Figure 3-7, lead concentrations are relatively low near the tank pit (16.6 to 27.3 mg/kg) and higher in the surface soils collected from the perimeter of the site (14.9 to 53.9 mg/kg).

Elevated lead concentrations are associated with high total PAH concentrations in samples from SB107 and SB108, but are not elevated in sample SS101. SS101 contains the highest concentrations of PAHs at the site.

3.6.3.2 Subsurface Vadose Zone Soil Samples

Eight subsurface soil samples were collected at the site: one each from borings SB102, SB103, SB105 through SB108, and two from SB104. All of the samples were collected from vadose zone soils at depths between 4 to 6 ft bgs. These sampling locations were presented previously on Figure 3-1, while the analytical results are presented in Table 3-16. Figure 3-8 presents a summary diagram of the distribution of VOCs, SVOCs, and lead within the subsurface soils at the site.

Volatile Organic Compounds

Three VOCs were detected in subsurface soil samples collected from the vadose zone; methylene chloride (4 $\mu\text{g/kg}$) at location SB105, 2-propanone (acetone) (30 $\mu\text{g/kg}$) at location SB107, and xylenes (total BTEX) at a concentration of 9600 $\mu\text{g/kg}$ from the 5.5 to 6 ft sample collected from SB104. No other VOCs were detected in the vadose zone soil samples. As was seen in the surface soil sampling, the lack of VOCs detected in the subsurface soils vadose zone is supported by the field PID readings obtained during drilling (see boring logs - Appendix C) and the absence of VOCs in the field GC analysis (Appendix E). Samples SB102-11.5, SB103-11, SB104-12, and SB105-9 were taken in the saturated zone and do not reflect subsurface vadose zone conditions. The occurrence of xylene in the soils from SB104 is likely the result of past releases of JP-4 jet fuel from the USTs.

Semi-volatile Organic Compounds

SVOCs detected in the Site 1 subsurface soils include 1,4-DCB, dibenzofuran, phthalate esters, and PAHs. As illustrated on Figure 3-8, PAHs were detected in 3 of the 8 soil samples (locations SB103,

**Table 3-16 Data Summary Table: Subsurface Soils - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

LOCATOR:
SAMPLE ID:
COLLECTION DATE:
ASSOCIATED FIELD QC:

SB102 SB103 SB104 SB104 SB105
CS1-SB2-5-55 CS1-SB3-45-5 CS1-SB4-45-5 CS1-SB4-55-6 CS1-SB5-45-5
11/18/92 11/18/92 11/18/92 11/18/92 11/18/92
TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1 TB1,FB1,FB2,ER1

UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
TYPE A Soil Cleanup Objectives												
VOCs												
2-Propanone	1	B	12	U	12	U	3200	U	12	U		
Methylene chloride	6	B	6	U	6	U	2100	B	4	J		
Xylenes (TOTAL)	6	U	6	U	6	U	9600		6	U		
SVOCs												
1,4-Dichlorobenzene	75		410	U	53		430	U	44			
2-Methylnaphthalene	420	U	410	U	400	U	590		410	U		
Benzo(a)anthracene	420	U	410	U	400	U	430	U	410	U		
Benzo(a)pyrene	420	U	410	U	400	U	430	U	410	U		
Benzo(b)fluoranthene	420	U	410	U	400	U	430	U	410	U		
Chrysene	420	U	410	U	400	U	430	U	410	U		
Di-n-butyl phthalate	33	U	26		30		48		410	U		
Dibenzofuran	420	U	410	U	400	U	430	U	410	U		
Diethyl phthalate	230		43		170		220		130			
Fluoranthene	420	U	22		400	U	430	U	410	U		
Fluorene	420	U	410	U	400	U	44		410	U		
Naphthalene	420	U	410	U	400	U	230		410	U		
Phenanthrene	420	U	410	U	400	U	430	U	410	U		
Pyrene	420	U	410	U	400	U	430	U	410	U		
bis(2-Ethylhexyl)phthalate	120	B	460	B	120	B	75	B	140	B		
METALS												
Lead ²	7.5 mg/kg	18.2	L	17.2	L	21.1	L	19.4	L	14.2	L	

¹Type A soil cleanup objective of 4200 ug/kg is total concentration for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.

²Type A soil cleanup objective for lead is 7.5 ug/L (TCLP).

Only those analytes detected in one or more samples are shown

() Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

Lab: COMPUCHEM

**Table 3-16 Data Summary Table: Subsurface Soils - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

LOCATOR:	SB106	SB107	SB108
SAMPLE ID:	CS1-SB6-4-6	CS1-SB7-5-5	CS1-SB8-5-55
COLLECTION DATE:	11/19/92	11/19/92	11/20/92
ASSOCIATED FIELD QC:	TB1,FB1,FB2,ER2	TB2,FB1,FB2,ER2	TB3,FB1,FB2,ER2

UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
-------	--------	------	--------	------	--------	------

TYPE A Soil Cleanup Objectives

VOCs

2-Propanone	ug/kg	11	U	30	15	B
Methylene chloride	ug/kg	5	U	6	28	B
Xylenes (TOTAL)	ug/kg	5	U	6	6	U

SVOCs

1,4-Dichlorobenzene	ug/kg	59		34	420	U
2-Methylnaphthalene	ug/kg	210		420	420	U
Benzo(a)anthracene	2.6 ug/kg	35		420	420	U
Benzo(a)pyrene	4.6 ug/kg	33		420	420	U
Benzo(b)fluoranthene	3.6 ug/kg	38	J	420	420	U
Chrysene	30 ug/kg	41		420	420	U
Di-n-butyl phthalate	ug/kg	20		420	56	B
Dibenzofuran	ug/kg	19		420	420	U
Diethyl phthalate	ug/kg	350	U	420	420	U
Fluoranthene	5600 ug/kg	86		420	420	U
Fluorene	5600 ug/kg	350	U	420	420	U
Naphthalene	25 ug/kg	230		420	420	U
Phenanthrene	4200 ug/kg ¹	150		420	420	U
Pyrene	4200 ug/kg	82		420	420	U
bis(2-Ethylhexyl)phthalate	ug/kg	130	B	180	57	B

METALS

Lead ²	7.5 mg/kg	7.1	L	19.4	14.5	L
-------------------	-----------	-----	---	------	------	---

¹Type A soil cleanup objective of 4200 ug/kg is total concentration for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.

²Type A soil cleanup objective for lead is 7.5 ug/L (TCLP).

Only those analytes detected in one or more samples are shown

0 Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

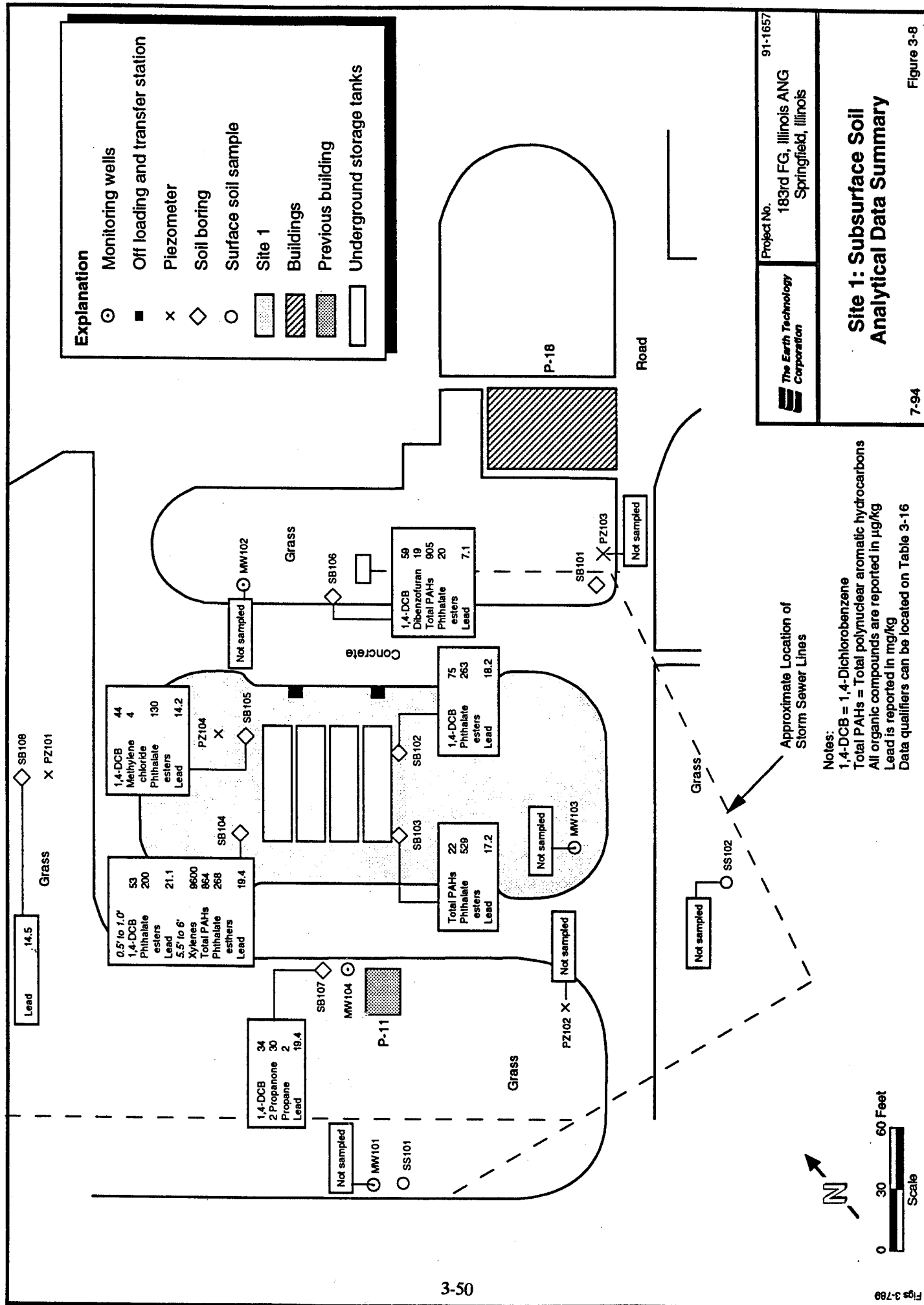
K Concentration or quantitation limit is biased high

L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

Lab: COMPUCEM



SB104 and SB106) in concentrations of 22 to 905 $\mu\text{g/kg}$. In contrast to the surface soil analytical results, a slightly different group of PAHs exists in the subsurface soils. Naphthalene and 2-methylnaphthalene, both absent from the surface soils, were present in samples collected from locations SB104 and SB106 in concentrations ranging from 210 J to 590 $\mu\text{g/kg}$. These compounds are relatively common constituents of petroleum-derived fuels.

The remaining SVOCs detected in the subsurface soils include 1,4-DCB (5 detections; 34 to 75 $\mu\text{g/kg}$), dibenzofuran (1 detection; 19 J $\mu\text{g/kg}$), and phthalate esters (6 detections; 20 to 529 $\mu\text{g/kg}$).

Lead

Lead concentrations in the site subsurface soils, as presented on Table 3-16 and summarized on Figure 3-8, range from 7.1 to 21.1 mg/kg. The range of lead concentrations in the facility background subsurface soils is 2.8 J to 28.2 J mg/kg. In general, lead concentrations are lower in the subsurface soils (maximum concentration 21.1 mg/kg) than in the surface soils (maximum concentration 53.9 mg/kg). Elevated lead concentrations are not associated with the BTEX and PAHs (probable fuel contamination) found in SB104 at depths between 5.5 and 6 ft.

3.6.3.3 Groundwater Samples

During the drilling of the soil borings SB102 through SB107 (tank pit area), soil samples were collected from saturated zone soils and screened using a field GC. VOCs were detected in relatively high concentrations from these soil samples indicating the presence of groundwater contamination around the tank pit area. Four groundwater monitoring wells, MW101 through MW104, were installed (see Figure 3-1) and sampled in December 1992 and again in April 1993 to provide data regarding the presence or absence of groundwater contamination. The analytical results are presented in Table 3-17 and are summarized on Figure 3-9.

Organic Compounds

As presented in Table 3-17 and Figure 3-9, organic compounds were detected during both rounds of sampling in groundwater samples obtained from MW102, MW103 and MW104. Monitoring well MW101, located farthest down-gradient of the tank pit was free of organic compounds during both rounds of sampling. Except for methylene chloride (0.17 $\mu\text{g/L}$) detected during the April 1993 sampling event, MW103 was also free of organic compounds. MW102, the sites up-gradient well contained low concentrations of 1,2-DCB, chloroform, methylene chloride, or di-n-butyl phthalate during either the December 1992 or April 1993 sampling event. No compounds generally associated with fuels were detected in MW102.

MW104, located immediately down-gradient of the tank pit, contained naphthalene (3 $\mu\text{g/L}$) and di-n-butyl phthalate (0.6 $\mu\text{g/L}$) during the December 1992 sampling and 17 individual organic compounds during the April 1993 sampling round. Ten of the 17 organic compounds were detected at concentrations equal to or less than 1 $\mu\text{g/L}$. BTEX including benzene (0.74 $\mu\text{g/L}$), ethylbenzene (0.29) and toluene (1.1 $\mu\text{g/L}$) were detected in the second round of sampling. In addition to compounds that are commonly associated with JP-4 fuel, dichlorobenzene isomers, styrene, chlorobenzene, 2,4-dinitrotoluene, chloroform, methylene chloride, and di-n-butyl and diethyl phthalates were detected in groundwater from MW104. Pesticides and PCBs were analyzed in groundwater from MW104 (April 1993 round) only. No detections were noted.

Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois

[illegible]

Only those analytes detected in one or more samples are shown

I	Value is between IDL and the CRDL
B	Compound or analyte detected in field or lab blank
J	Concentration is estimated
K	Concentration or quantitation limit is biased high
-	Analysis not performed

** No ILEPA criteria available, Federal MCL used for total trihalomethanes
 L Concentration or quantitation limit is biased low
 R Data is unreliable
 U Compound was analyzed for but not detected

Lab: PACE 1992, COMPUchem 1993

**Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator: MW101
Sample ID: CS1-MW1-GW1
Collection Date: 12/06/92
Associated Field QC Samples: TB10,FB3,FB4,ER4

MW101 CS1-MW1-GW1-F 12/06/92 TB10,FB4,TB10,ER4
MW101 CS1-MW1-GW2 04/14/93 TB11,FB5,FB6,ER10
MW101 CS1-MW1-GW2-F 04/14/93 FB5,FB6,TB11,ER10
MW102 CS1-MW2-GW1 12/06/92 TB10,FB3,FB4,ER4

	UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
ILEPA CLASS I											
METALS											
Iron	5000 ug/l	-									
Lead	7.5 ug/l	5.1	K	1	B	5770	J	5530	J	-	
Magnesium	ug/l	-		-		7.1	L	2	U	7.3	K
Manganese	150 ug/l	-		-		34600		57000	B	-	
Sodium	ug/l	-		-		1570		2680		-	
Vanadium	ug/l	-		-		8080	B	13500	B	-	
Zinc	5000 ug/l	-		-		7	U	7	U	-	
		-		-		18.3	OB	39.8		-	

Only those analytes detected in one or more samples are shown

- () Value is between IDL and the CRDL
 B Compound or analyte detected in field or lab blank
 J Concentration is estimated
 K Concentration or quantitation limit is biased high
 - Analysis not performed
- ** No ILEPA criteria available, Federal MCL used for total trihalomethanes
 L Concentration or quantitation limit is biased low
 R Data is unreliable
 U Compound was analyzed for but not detected

Lab: PACE 1992, COMPUCHEM 1993

wp13-17.942-February 22, 1996

**Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator:
Sample ID:
Collection Date:
Associated Field QC Samples:

MW102	MW102	MW102	MW102	MW103	MW103	MW103
CS1-MW2-GW1-F	CS1-MW2-GW2	CS1-MW2-GW2-F	CS1-MW3-GW1	CS1-MW3-GW1	CS1-MW3-GW1-F	CS1-MW3-GW1-F
12/06/92	04/14/93	04/14/93	12/06/92	12/06/92	12/06/92	12/06/92
FB3,FB4,TB10,ER4	TB11,FB5,FB6,ER10	FB5,FB6,TB11,ER10	TB10,FB3,FB4,ER4	TB10,FB3,FB4,ER4	TB10,FB3,FB4,ER4	TB10,FB3,FB4,ER4

UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
ILEPA CLASS I								
VOC								
1,2-Dimethylbenzene	ug/l	0.2	U					
1,3-Dichlorobenzene	ug/l	0.2	U				1	UJ
1,3-Dimethylbenzene	ug/l							
1,4-Dichlorobenzene	75 ug/l	0.2	U				1	UJ
1,4-Dimethylbenzene	ug/l							
Benzene	5 ug/l	0.35	U				1	UJ
Chlorobenzene	100 ug/l	0.35	U				1	UJ
Chloroform	100** ug/l	1	U				1	UJ
Ethylbenzene	700 ug/l	0.2	U				1	UJ
Methyl-t-Butyl Ether	5 ug/l	5	U					
Methylene chloride	5 ug/l	0.47	B				1	UJ
Styrene	100 ug/l	0.25	U					
Toluene	1000 ug/l	0.25	U				1	UJ
SVOC								
2,4-Dinitrotoluene	ug/l	10	U				10	U
2-Methylnaphthalene	ug/l	10	U				10	U
Di-n-butyl phthalate	ug/l	10	U				10	U
Diethyl phthalate	ug/l	10	U				10	U
Naphthalene	ug/l	10	U				10	U
METALS								
Aluminum	ug/l	12300	J		64.8	0B	-	-
Arsenic	50 ug/l	3.5	0		3	U	-	-
Barium	2000 ug/l	113	0		82.5	0B	-	-
Calcium	ug/l	73500			77000	B	-	-
Cobalt	100 ug/l	9	U		9	U	-	-

Only those analytes detected in one or more samples are shown

0 Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

- Analysis not performed

** No ILEPA criteria available, Federal MCL used for total trihalomethanes
L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

Lab: PACE 1992, COMPUCEM 1993

**Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator:
Sample ID:
Collection Date:
Associated Field QC Samples:

MW102 CS1-MW2-GW1-F 12/06/92 MW103 CS1-MW3-GW1 12/06/92
FB3,FB4,TB10,ER4 TB11,FB5,FB6,ER10 FB5,FB6,TB11,ER10 TB10,FB3,FB4,ER4

	UNITS	MW102		MW102		MW102		MW103		MW103	
		RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
METALS											
Iron	5000 ug/l	-		780	J	8.4	(B)	-		-	
Lead	7.5 ug/l	2.60	(B)	4.20	L	2.00	U	9.40	K	1.00	B
Magnesium	ug/l	-		38400.00	B	40100.00	B	-		-	
Manganese	150 ug/l	-		117.00		43.60		-		-	
Sodium	ug/l	-		10600.00		11300.00	B	-		-	
Vanadium	ug/l	-		7.00	U	7.00	U	-		-	
Zinc	5000 ug/l	-		50.10	B	12.70	()	-		-	

ILEPA CLASS I

Only those analytes detected in one or more samples are shown
 () Value is between IDL and the CRDL
 B Compound or analyte detected in field or lab blank
 J Concentration is estimated
 K Concentration or quantitation limit is biased high
 - Analysis not performed

** No ILEPA criteria available. Federal MCL used for total trihalomethanes
 L Concentration or quantitation limit is biased low
 R Data is unreliable
 U Compound was analyzed for but not detected

Lab: PACE 1992, COMPUCHEM 1993

wpt3-17.942, February 22, 1996

**Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator:
Sample ID:
Collection Date:
Associated Field QC Samples:

MW103	MW103	MW104	MW104	MW104	MW104
CS1-MW3-GW2	CS1-MW3-GW2-F	CS1-MW4-GW1	CS1-MW4-GW1-F	CS1-MW4-GW2	
04/14/93	04/14/93	12/06/92	12/06/92	04/15/93	
TB11,FB5,FB6,ER10	TB11,FB5,FB6,ER10	TB10,FB3,FB4,ER4	TB12,FB3,FB4,ER4	TB12,FB5,FB6,ER10	

	UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
ILEPA CLASS I									
VOC									
1,2-Dimethylbenzene	ug/l	0.2	U					0.69	
1,3-Dichlorobenzene	ug/l	0.2	U	1	UJ			8.2	
1,3-Dimethylbenzene	ug/l							1.6	
1,4-Dichlorobenzene	75 ug/l	0.2	U	1	UJ			0.1	
1,4-Dimethylbenzene	ug/l							0.17	
Benzene	5 ug/l	0.35	U	1	UJ			0.74	
Chlorobenzene	100 ug/l	0.35	U	1	UJ			1	
Chloroform	100** ug/l	0.35	U	1	UJ			0.23	
Ethylbenzene	700 ug/l	0.2	U	1	UJ			0.29	
Methyl-t-Butyl Ether	5 ug/l	5	U					77	
Methylene chloride	ug/l	0.17	U	1	UJ			0.69	
Styrene	100 ug/l	0.25	U					0.44	
Toluene	1000 ug/l	0.25	U	1	UJ			1.1	
SVOC									
2,4-Dinitrotoluene	ug/l	10	U	10	U			8	
2-Methylnaphthalene	ug/l	10	U	10	U			3	
Di-n-butyl phthalate	ug/l	10	U	0.6				1	
Diethyl phthalate	ug/l	10	U	10	U			2	
Naphthalene	ug/l	10	U	3				11	
METALS									
Aluminum	ug/l	758	B	58	(B)			-	
Arsenic	50 ug/l	3.4	(B)	3	U			-	
Barium	2000 ug/l	101	U	87.3	(B)			-	
Cobalt	ug/l	9	U	9	U			-	
Calcium	100 ug/l	79000		79500	B			-	

Only those analytes detected in one or more samples are shown

- () Value is between IDL and the CRDL
 B Compound or analyte detected in field or lab blank
 J Concentration is estimated
 K Concentration or quantitation limit is biased high
 - Analysis not performed
- ** No ILEPA criteria available, Federal MCL used for total trihalomethanes
 L Concentration or quantitation limit is biased low
 R Data is unreliable
 U Compound was analyzed for but not detected

Lab: PACE 1992, COMPUTCHEM 1993

wpt3-17.942-February 22, 1996

**Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator:
Sample ID:
Collection Date:
Associated Field QC Samples:

MW103 CS1-MW3-GW2 04/14/93 TB11,FB5,FB6,ER10
MW103 CS1-MW3-GW2-F 04/14/93 TB11,FB5,FB6,ER10
MW104 CS1-MW4-GW1 12/06/92 TB10,FB3,FB4,ER4
MW104 CS1-MW4-GW1-F 12/06/92 TB12,FB3,FB4,ER4
MW104 CS1-MW4-GW2 04/15/93 TB12,FB5,FB6,ER10

	UNITS	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL	RESULT	QUAL
METALS											
Iron	5000 ug/l	438	J	6	U	-	-	-	-	-	-
Lead	7.5 ug/l	7.8	L	2	U	6.7	K	1	B	2	U
Magnesium	ug/l	40300		40200	B	-	-	-	-	-	-
Manganese	150 ug/l	32		6	U	-	-	-	-	-	-
Sodium	ug/l	7670		8700	B	-	-	-	-	-	-
Vanadium	ug/l	7	U	7	U	-	-	-	-	-	-
Zinc	5000 ug/l	10.7	(B)	3	U	-	-	-	-	-	-

ILEPA CLASS I

Only those analytes detected in one or more samples are shown
 () Value is between IDL and the CRDL
 B Compound or analyte detected in field or lab blank
 J Concentration is estimated
 K Concentration or quantitation limit is biased high
 - Analysis not performed

** No ILEPA criteria available, Federal MCL used for total trihalomethanes
 L Concentration or quantitation limit is biased low
 R Data is unreliable
 U Compound was analyzed for but not detected

**Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

Locator: MW104
Sample ID: CS1-MW4-GW2-F
Collection Date: 04/15/93
Associated Field QC Samples: TB12,FB5,FB6,ER10

	UNITS	RESULT	QUAL
VOC			
ILEPA CLASS I			
1,2-Dimethylbenzene	ug/l		
1,3-Dichlorobenzene	ug/l		
1,3-Dimethylbenzene	ug/l		
1,4-Dichlorobenzene	75 ug/l		
1,4-Dimethylbenzene	ug/l		
Benzene	5 ug/l		
Chlorobenzene	100 ug/l		
Chloroform	100** ug/l		
Ethylbenzene	700 ug/l		
Methyl-t-Butyl Ether	ug/l		
Methylene chloride	5 ug/l		
Styrene	100 ug/l		
Toluene	1000 ug/l		
SVOC			
ILEPA CLASS I			
2,4-Dinitrotoluene	ug/l		
2-Methylnaphthalene	ug/l		
Di-n-butyl phthalate	ug/l		
Diethyl phthalate	ug/l		
Naphthalene	ug/l		
METALS			
Aluminum	ug/l	-	
Arsenic	50 ug/l	-	
Barium	2000 ug/l	-	
Calcium	ug/l	-	
Cobalt	100 ug/l	-	
ILEPA CLASS I			

Only those analytes detected in one or more samples are shown

() Value is between IDL and the CRDL

B Compound or analyte detected in field or lab blank

J Concentration is estimated

K Concentration or quantitation limit is biased high

- Analysis not performed

** No ILEPA criteria available, Federal MCL used for total trihalomethanes

L Concentration or quantitation limit is biased low

R Data is unreliable

U Compound was analyzed for but not detected

Lab: PACE 1992, COMPUCHEM 1993

wpt3-17,942,February 22, 1996

**Table 3-17 Data Summary Table: Groundwater - Site 1 POL Storage Area
Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois**

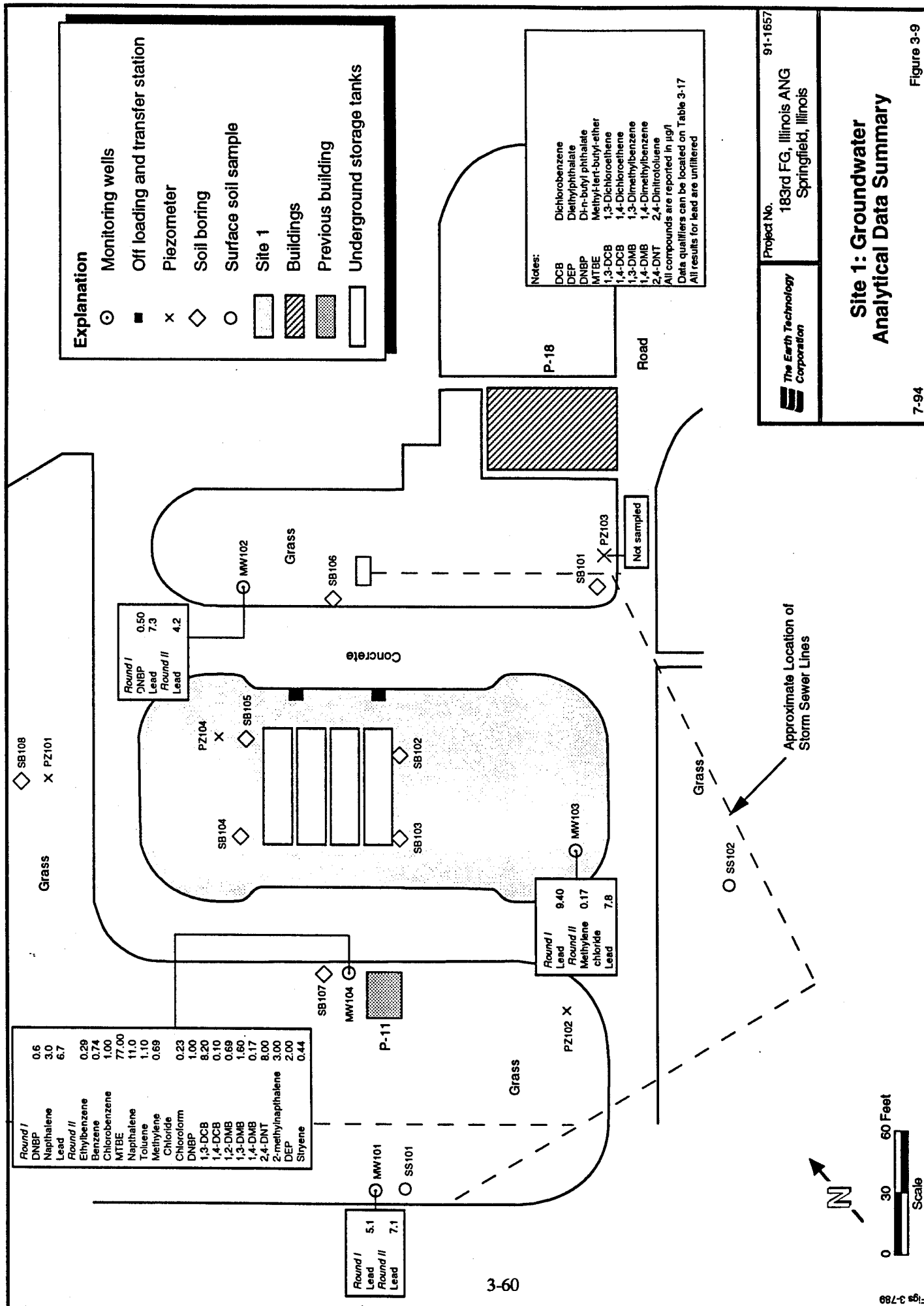
Locator: MW104
Sample ID: CS1-MW4-GW2-F
Collection Date: 04/15/93
Associated Field QC Samples: TB12,FB5,FB6,ER10

	UNITS	RESULT	QUAL
METALS			
Iron	5000 ug/l	-	
Lead	7.5 ug/l	2	U
Magnesium	ug/l	-	
Manganese	150 ug/l	-	
Sodium	ug/l	-	
Vanadium	ug/l	-	
Zinc	5000 ug/l	-	

Only those analytes detected in one or more samples are shown
 () Value is between IDL and the CRDL
 B Compound or analyte detected in field or lab blank
 J Concentration is estimated
 K Concentration or quantitation limit is biased high
 - Analysis not performed

** No ILEPA criteria available, Federal MCL used for total trihalomethanes
 L Concentration or quantitation limit is biased low
 R Data is unreliable
 U Compound was analyzed for but not detected

Lab: PACE 1992, COMPUTCHEM 1993



The presence of BTEX, dimethylbenzene isomers, naphthalene, 2-methylnaphthlene and methyl-tert-butyl ether indicate the presence of contamination by JP-4 jet fuel. The low concentrations of BTEX detected in MW104 indicates the well is likely monitoring the leading edge of the groundwater plume existing beneath the tank pit.

Lead

Filtered and unfiltered groundwater samples were collected from Site 1 monitoring wells and analyzed for lead. These results provide data on the dissolved (filtered samples) and total (unfiltered samples) lead content of the Site 1 groundwater. The high lead content (35.7 $\mu\text{g/L}$ in CFB-6) in the field blank obtained from the base potable water supply during the second round of groundwater sampling resulted in the qualification of associated groundwater results for lead as "B", indicating blank contamination. As a result, usable lead data exists only for the first round of sampling. As presented on Table 3-7 and Figure 3-9, unfiltered lead values range across from 5.1K to 9.4 $\mu\text{g/L}$. In contrast, lead was detected in only one filtered sample (location MW102) at 2.6 $\mu\text{g/L}$.

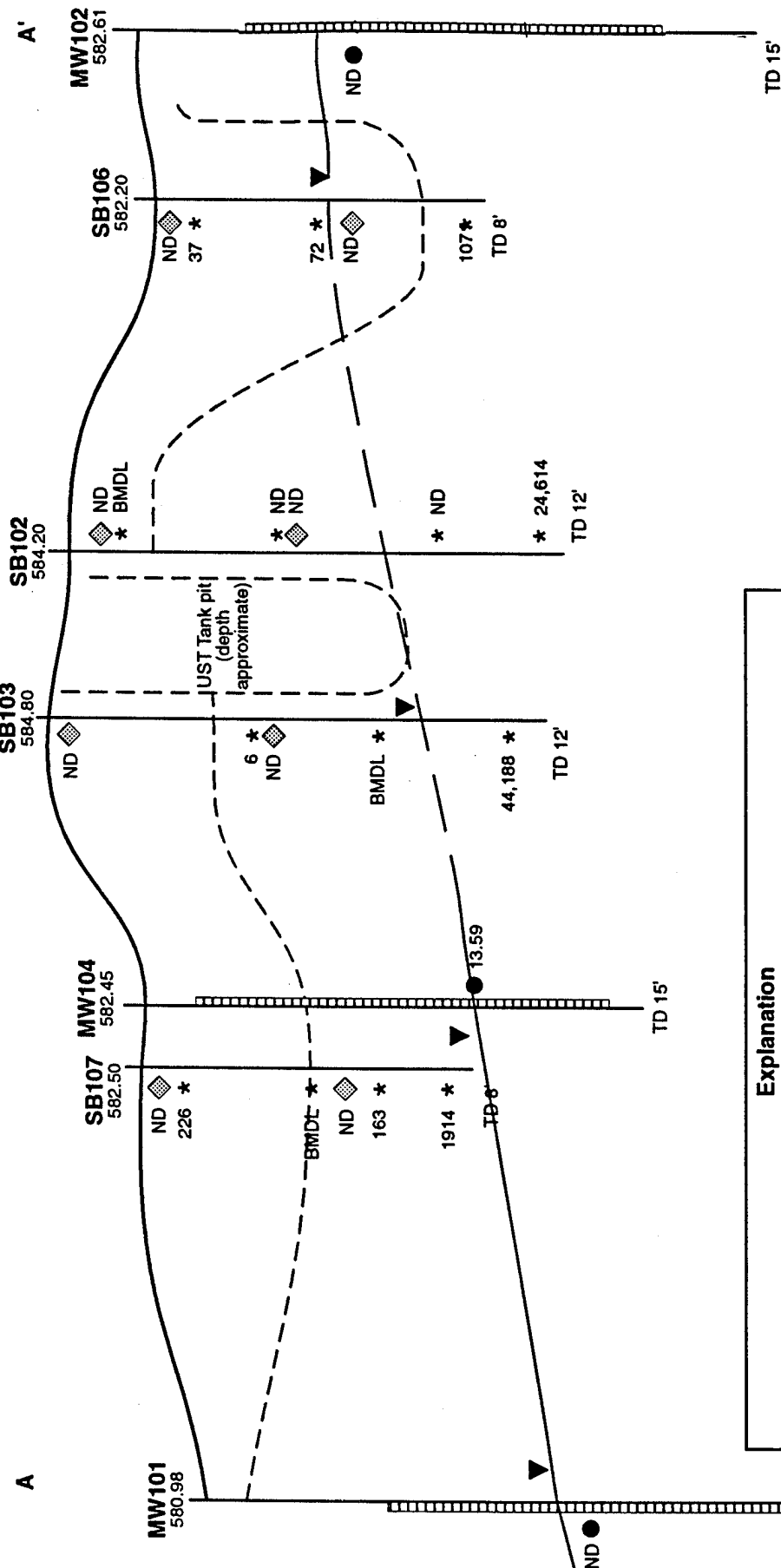
3.6.3.4 Conclusions

JP-4 jet fuel has likely been released into the subsurface environment at Site 1. Conclusions regarding the origin of the VOCs, SVOCs, and lead detected in the media sampled at the site are included in the following discussions.

VOCs, including BTEX compounds were detected in the soil and groundwater samples. A majority of the VOCs were detected infrequently and at low concentrations. BTEX compounds occur around the tank pit area. Figures 3-10 and 3-11 present summary profiles illustrating the horizontal and vertical extent of BTEX compounds at the site. These figures are profiles A-A' and B-B' showing only the sampling locations and BTEX concentrations obtained from each field GC and fixed-base soil and groundwater analysis. As presented on these figures, BTEX compounds are generally absent from the surface and vadose zone soil samples. Samples collected from SB106 are the exception. This boring was drilled through the backfill of the storm sewer trench, indicating that some JP-4 has probably been washed off of the concrete surrounding the tank pit and into the storm sewer system. Of the 16 soil samples collected and submitted for fixed-base laboratory analysis, only the 5.5 to 6 ft sample collected from SB104 contained detectable amounts of BTEX. This sample contained xylenes quantified at 9600 $\mu\text{g/kg}$, below the Illinois UST regulatory limit of 11,750 $\mu\text{g/kg}$. However, as quantified by field GC analytical methods the saturated zone around the tank pit contains relatively high concentrations of BTEX compounds. These data are indicative of groundwater contamination resulting from a release of JP-4. No soil samples were collected and analyzed in a fixed-base laboratory from below the water table.

Monitoring wells MW101 through MW104 were installed to monitor groundwater contamination at the site. MW102 was installed as the up-gradient well, while MW104 and MW101 were installed southwest and down-gradient of the tank pit (Figure 3-9). Only the groundwater samples from MW104 contain BTEX compounds. Benzene, toluene, and ethylbenzene were detected during the second round of groundwater sampling at relatively low concentrations, and all below any applicable state or federal regulatory limit.

SVOCs detected at the site include 1,4-DCB, methoxychlor, carbazole, dibenzofuran, PAHs, and phthalate esters. Many of the compounds, including methoxychlor, carbazole, and dibenzofuran were detected infrequently and at relatively low concentrations. However, 1,4-DCB, PAHs, and phthalate esters were detected more frequently and in some cases at relatively high concentrations.



Project No. 91-1657
183rd FG, Illinois ANG
Springfield, Illinois

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Figure 3-10

7-94

One of the uses of 1,4-DCB is as a soil fumigant and general insecticide (Hawley, 1981). Its use as a pesticide may explain its widespread occurrence at relatively low concentrations in the soils at the site. Phthalate esters, due to their widespread use in the manufacture of plastics and use in laboratory equipment are commonly detected in environmental samples. The detections of the phthalate esters at relatively low concentrations may not reflect actual contamination, but may be artifacts of the sampling and analysis process. Neither 1,4-DCB or phthalate esters are common constituents of JP-4.

PAHs are typically present in JP-4. Two distinct groups of PAHs occur in the soil samples collected and analyzed from the site. Subsurface soil samples contain naphthalene and 2-methylnaphthalene as the most commonly detected members of the PAH family. These two compounds are absent from the surface soil samples, which in contrast contain relatively high concentrations of other PAHs, such as anthracene, chrysene, fluoranthene, etc. All of these compounds are potentially associated with fuel releases from the USTs, or from past reported fuel spills. As stated in Section 3.4.3.1 the PAH concentrations are generally higher in the surface soil samples collected from the perimeter of the site than from the samples nearer the tank pit. The PAHs may have originated from fuel spilled onto the ground at the site which was then washed off the concrete into the grass or toward the storm sewers. However, PAH concentrations tend to increase towards the aircraft parking apron (SS101 and SB108 in Figure 3-7). An alternate origin for the occurrence of these compounds is by airborne transport of contaminants from the incomplete combustion of JP-4, or surface water transport off the aircraft parking apron and/or runways.

Lead was detected in a majority of the surface and subsurface soil and groundwater samples obtained from Site 1. A comparison of background surface and subsurface soil and up-gradient monitoring well analytical results to site specific results indicate elevated lead concentrations probably exist only in the surface soil samples. Six of the nine surface soil samples contain lead in concentrations greater than 17.3 mg/kg, the upper range of the background surface soil samples. Concentrations of lead and PAHs show similar trends and have likely been transported in the same manner. Concentrations of lead in the groundwater are comparable to what was found in MW102, the sites up-gradient well.

3.7 SITE 2 - OLD FIRE TRAINING AREA

The following investigation activities were conducted at Site 2 (sample totals include QA/QC duplicates, if applicable):

- 58 samples (28 soil gas, 14 soil, and 16 groundwater) were collected and analyzed in the field by Burlington Environmental, Inc. using a Geoprobe unit and portable GC.
- 13 boreholes were drilled at the site.
 - 7 of these boreholes were completed as soil borings.
 - 3 of these boreholes were completed as piezometers.
 - 3 of these boreholes were complete as monitoring wells.
- 28 soil samples from these borings were collected and screened for selected VOCs using a field GC.

- 17 soil samples (including 2 background surface soils) and 3 sediment samples were collected and submitted for analysis of VOCs, SVOCs, pesticides/PCB, and TAL metals.
- 1 soil sample was collected and analyzed for the geotechnical parameters listed in Section 2.2.3.
- 6 groundwater and 3 surface water samples were collected and submitted for analysis of VOCs, SVOCs, pesticides/PCBs, and total and dissolved TAL metals. Two rounds of samples were collected from three monitoring wells. One round of samples was collected from three surface water locations.
- 2 rounds of groundwater elevation measurements were collected.
- 2 slug tests were conducted in monitoring wells MW201 and MW203.

Confirmation round surface soil, sediment and surface water sampling, soil boring, piezometer, and monitoring well locations are presented in Figure 3-12.

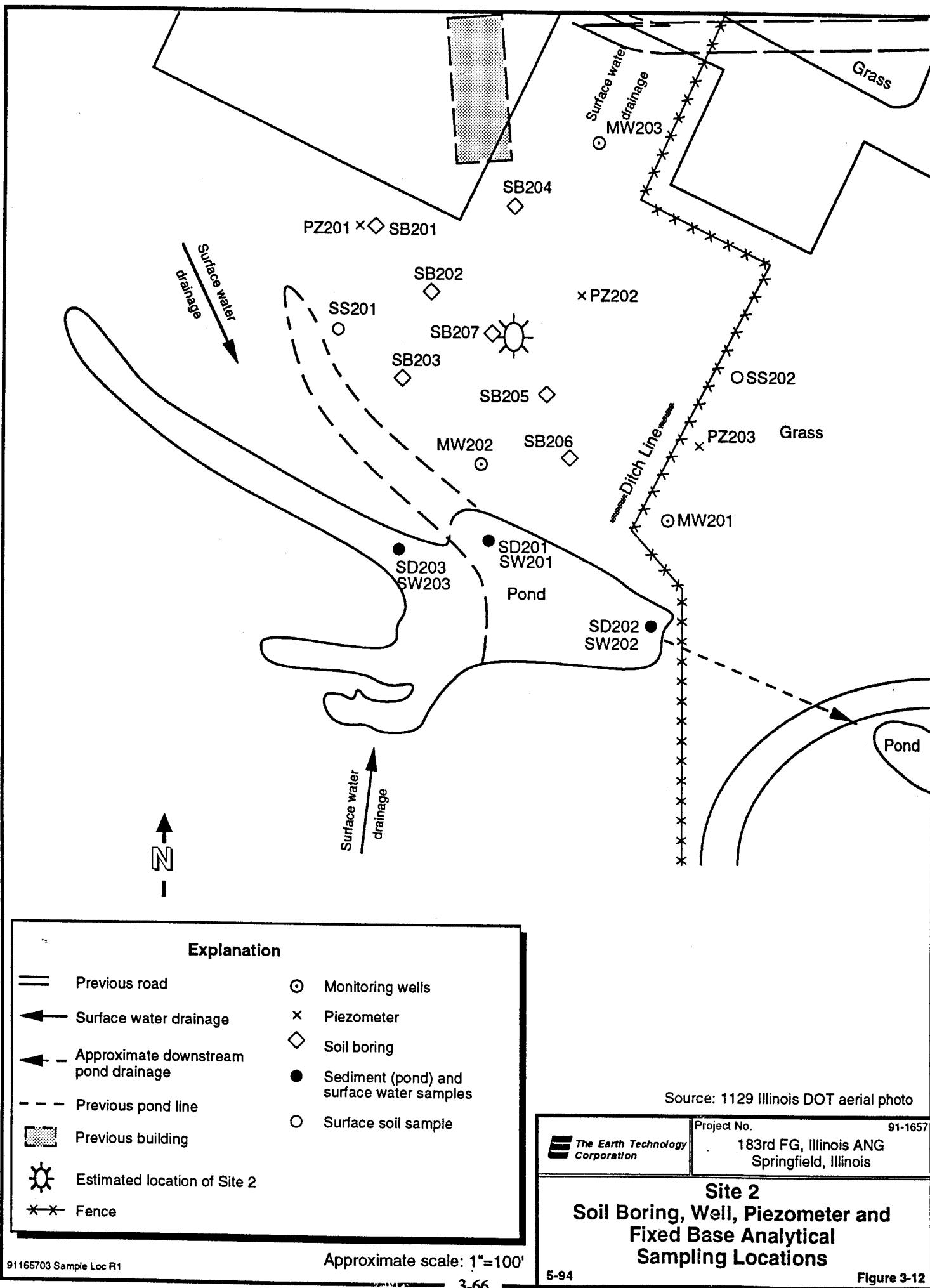
3.7.1 Site Geology and Hydrogeology

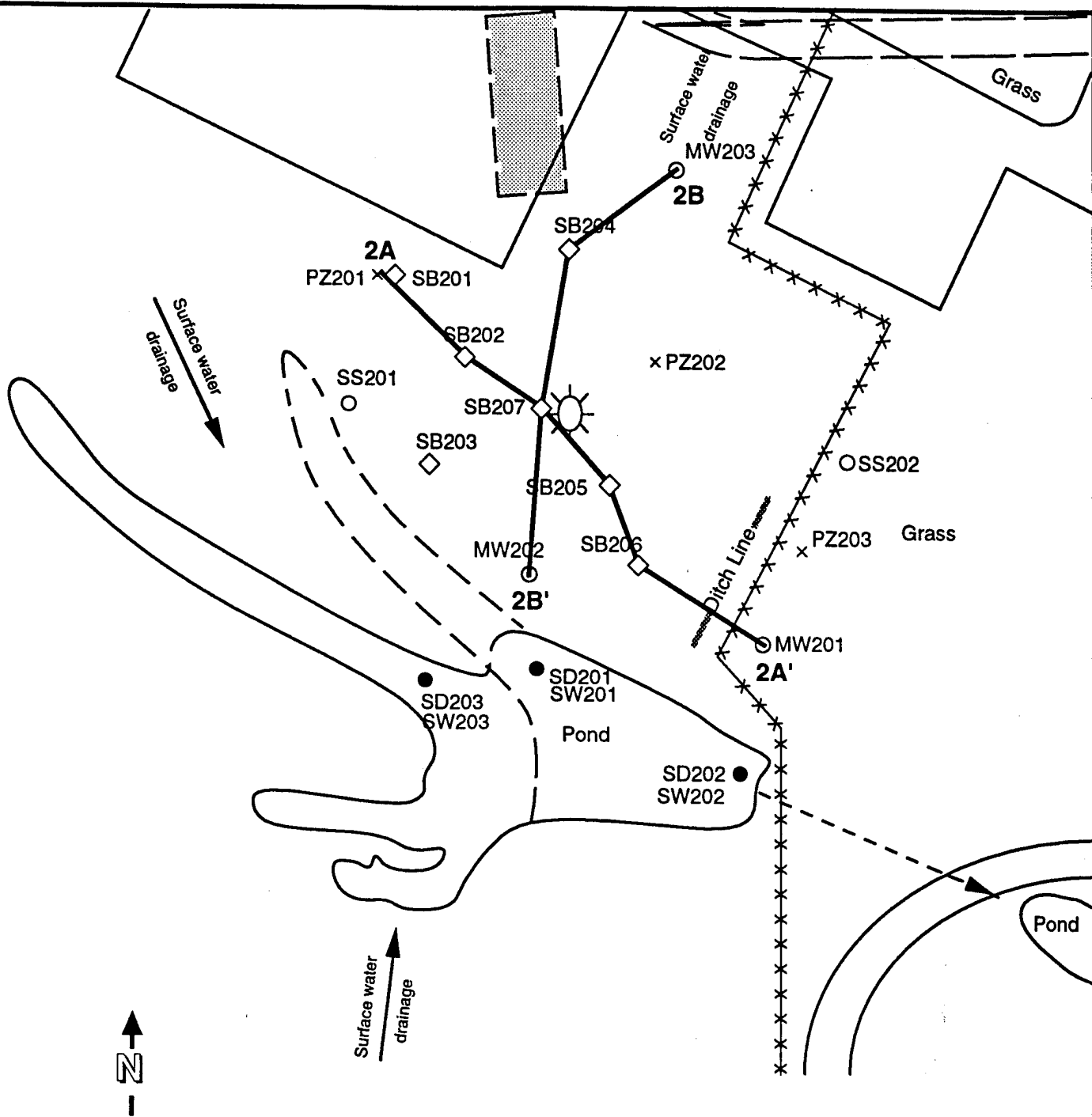
Geology

As discussed in Section 3.1, soils underlying the base are clay and silt-rich. Figure 3-13 indicates lines of cross section for Site 2. Figures 3-14 and 3-15 present geologic profiles illustrating the subsurface relationships discussed in Section 3.1. A comparison of aerial photographs taken before and after the construction of the hangars and aircraft parking area near the old FTA (1975-1989) indicates construction activities have had a significant impact on near-surface soils and topography at the site. As such, fill material predominates in the upper few feet of the site soil profile. Fill material was differentiated from native soils by the presence of brick fragments, sticks, and/or gravel. Fill thickness ranges from 0 to 6.5 ft at the site. The sequence of soil types encountered at Site 2 is similar to the sequence of soils drilled and logged at the POL Area. Fill material, where present, overlies native clay soils. A silt layer, as noted in soil borings SB203 through SB207, exists in the central and eastern portions of the site, and is underlain by a clay layer. SB201 was continuously sampled to bedrock (based on auger refusal), which was encountered at 26 ft bgs.

Hydrogeology

Three piezometers (PZ201, PZ202, and PZ203) were installed during the initial round of confirmation activities (November 16 through 25, 1992) (Figure 3-12). Groundwater elevation measurements were obtained from these piezometers and the surface of the pond (November 24, 1992) and used in combination with the survey data to create groundwater elevation maps. Up-gradient and down-gradient monitoring wells (MW201, MW202, and MW203) were installed based on these data (Figure 3-12). After the installation of the monitoring wells, groundwater elevation measurements were obtained again on December 7, 1992 and April 12, 1993. A groundwater elevation contour map (Figure 3-16) was created for Site 2 which illustrates the December 7, 1992 data. As shown on Figure 3-16, groundwater flow is to the southeast at an average hydraulic gradient of 0.0117 ft/ft. As also illustrated on Figure 3-16, MW201 and MW202 are placed in locations down-gradient of the suspected source areas. MW201 was installed to monitor groundwater quality between the suspected burn area and the pond, while MW202 was installed to monitor groundwater quality down-gradient of the site. MW203 was installed to serve as the up-gradient site monitoring well.





Explanation

- | | |
|--------------------------------------|---|
| Previous road | Monitoring wells |
| Surface water drainage | Piezometer |
| Approximate downstream pond drainage | Soil boring |
| Previous pond line | Sediment (pond) and surface water samples |
| Previous building | Surface soil sample |
| Estimated location of Site 2 | |
| Fence | |

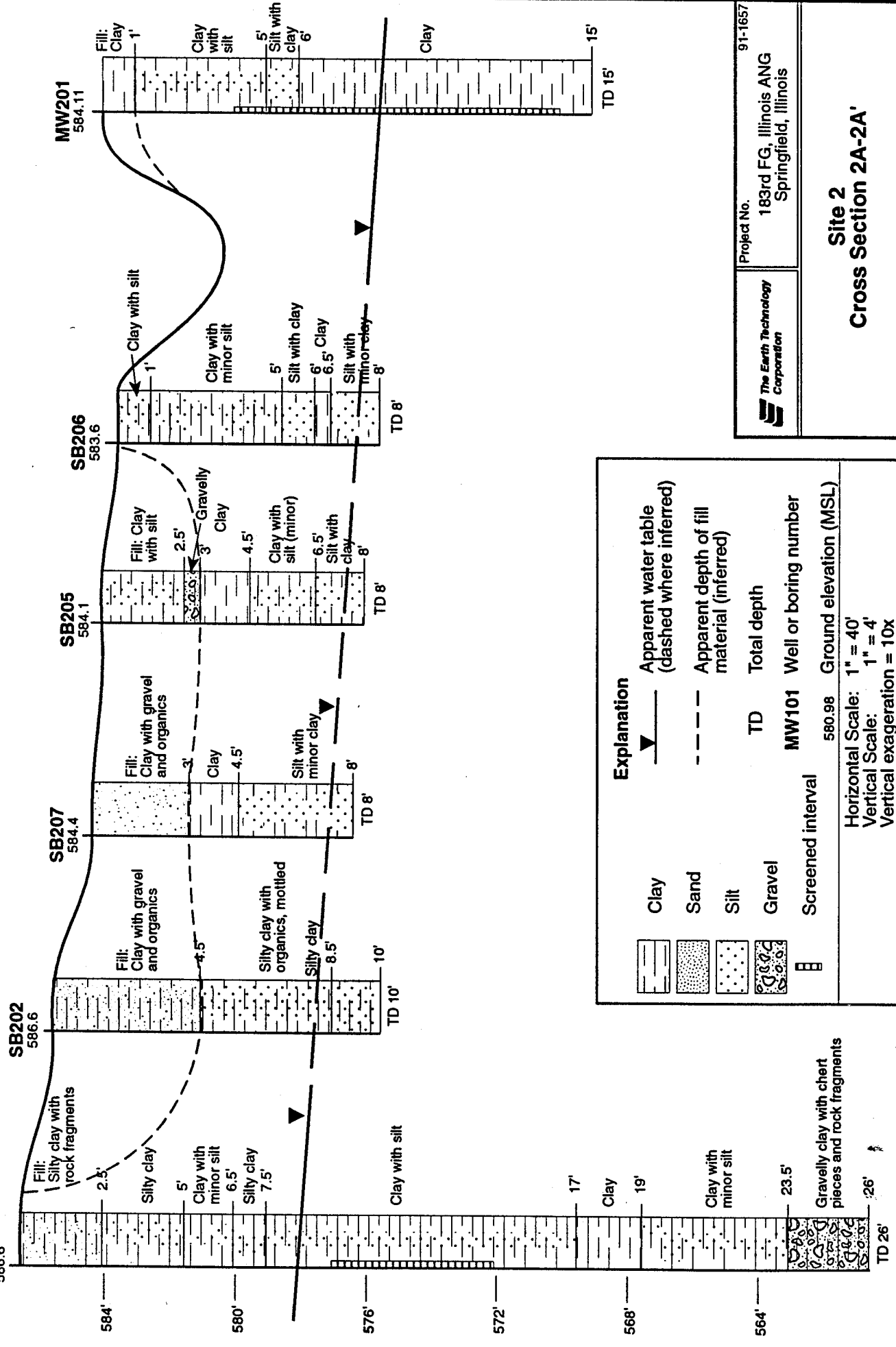
Source: 1129 Illinois DOT aerial photo

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Project No. 91-1657
183rd FG, Illinois ANG
Springfield, Illinois

Site 2 - Lines of Cross Section

2A
SB201
PZ201
586.6



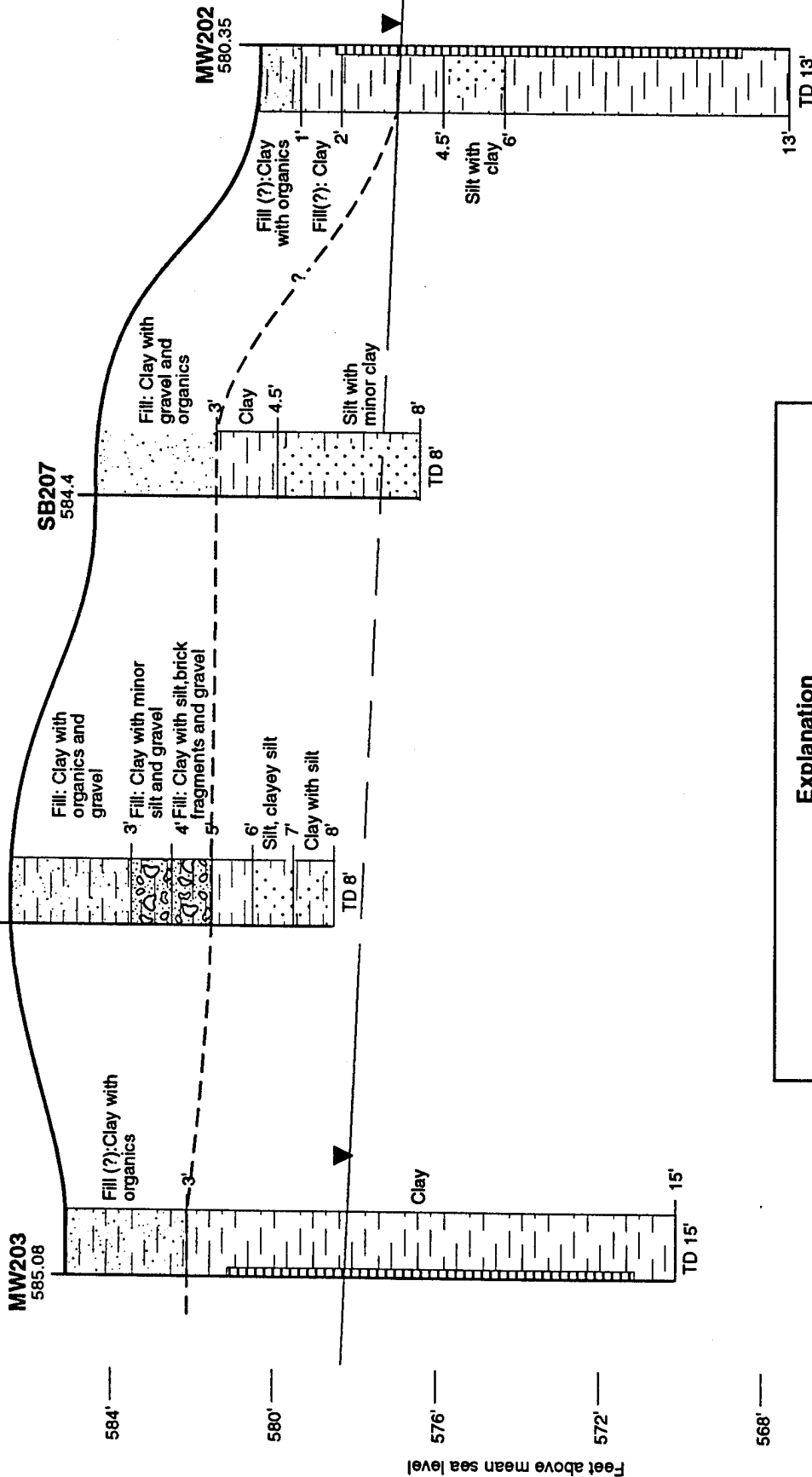
Explanation	
	Clay
	Sand
	Silt
	Gravel
	Screened interval
	Apparent water table (dashed where inferred)
	Apparent depth of fill material (inferred)
	Total depth
	Well or boring number
	Ground elevation (MSL)
Horizontal Scale: 1" = 40'	
Vertical Scale: 1" = 4'	
Vertical exaggeration = 10x	

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Project No. 91-1657
183rd FG, Illinois ANG
Springfield, Illinois

Site 2 Cross Section 2A-2A'

2B

2B'



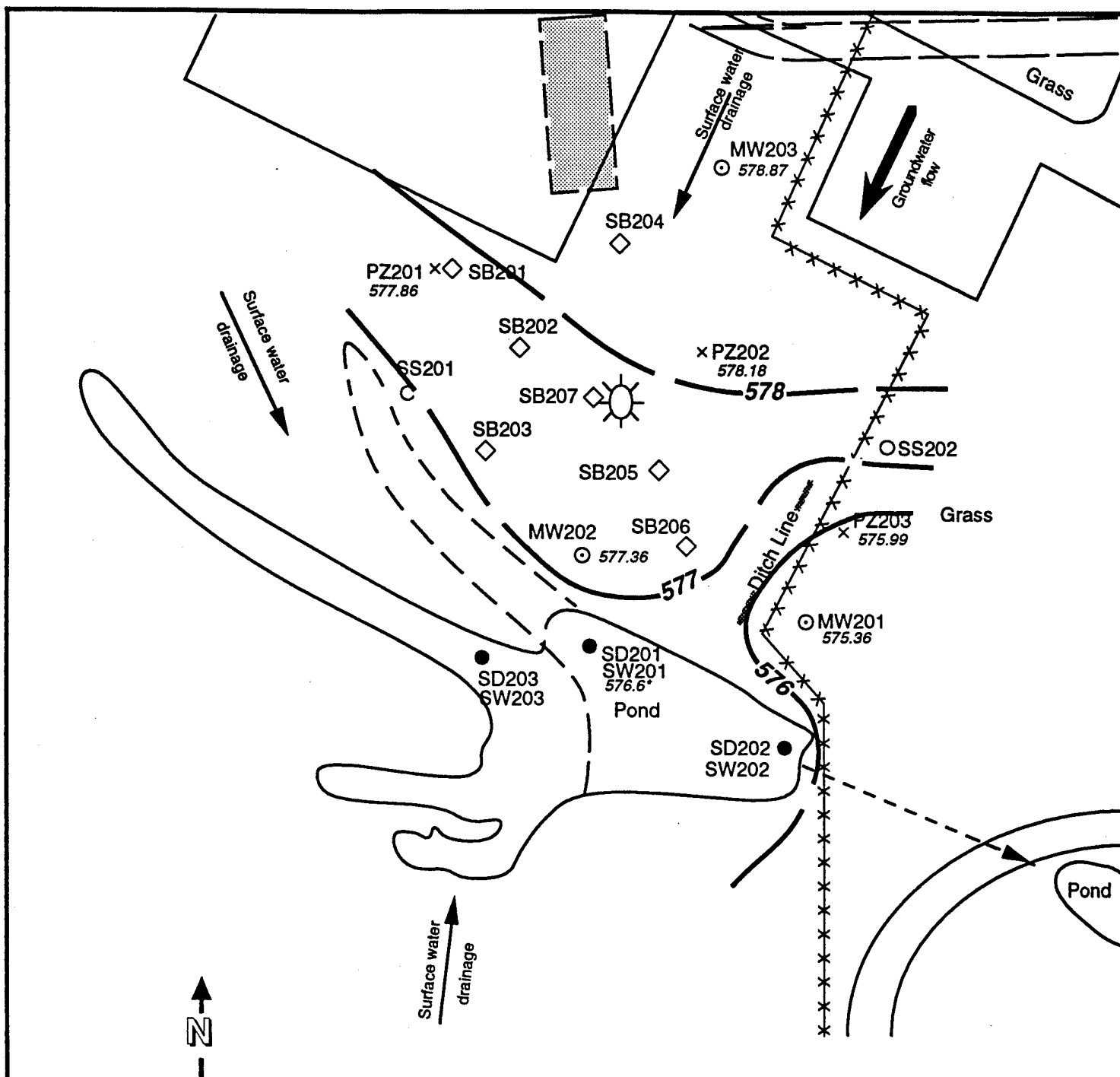
Explanation	
	Clay
	Sand
	Silt
	Gravel
	Screened interval
	Apparent water table (dashed where inferred)
	Apparent depth of fill material (inferred)
TD	Total depth
MW101	Well or boring number
580.98	Ground elevation (MSL)
Horizontal Scale: 1" = 40'	
Vertical Scale: 1" = 4'	
Vertical exaggeration = 10x	

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Project No. 91-1657
183rd FG, Illinois ANG
Springfield, Illinois

Site 2
Cross Section 2B-2B'

7-94

Figure 3-15



Hydraulic conductivity (K) measurements and groundwater velocities were calculated per well, based on data generated from falling and rising head slug tests. Slug test derived K values range from 1.614×10^{-4} to 1.846×10^{-4} cm/sec. The average K for Site 2 is 1.73×10^{-4} cm/sec. Average groundwater velocity and aquifer transmissivity, calculated by the methods described in Section 3.1.2, are 5.66 ft/yr and 0.155 cm²/sec, respectively. Site 2 aquifer slug test data are presented in the following table.

Well Number	Average Hydraulic Conductivity (k-cm/sec)	Groundwater Velocity (ft/year)
MW 202	1.614×10^{-4}	5.475
MW 203	1.846×10^{-4}	5.84
Site 2 Average	1.73×10^{-4}	5.66

3.7.2 Screening Activity Results

Screening activities conducted at Site 2 included Geoprobe sampling of soil gas, soil, and groundwater and field GC analysis of soil samples collected during drilling of the confirmation round soil borings.

3.7.2.1 Soil Gas, Soil, and Groundwater Screening Results

Screening activity results include the soil gas, soil, and groundwater screening survey conducted by Burlington Environmental, Inc. All samples were collected and analyzed using the methods described in Section 2.3.1. The complete data set is included in Appendix D. The screening locations are presented on Figure 3-17. Samples were collected from a total of 40 probehole locations at Site 2. Twenty-eight soil gas samples were collected from 23 locations, 14 soil samples were collected from 13 locations, and 16 groundwater samples were collected from 15 locations. Sampling locations S2-01, S2-06, S2-10, S2-14, S2-18, S2-23, and S2-36 were sampled at successive depths to determine if vertical concentration gradients exist in the subsurface. Information gained by sampling one location at successive depths was used to determine the optimal sampling depth for the remainder of the survey. The screening data gathered during this investigation suggest that relatively high concentrations of TVOCs are present in the subsurface soils and groundwater. Figure 3-17 presents an isoconcentration map of the TVOCs detected in the soil and groundwater samples only, at or below the saturated zone. As illustrated in Figure 3-17, TVOC concentrations in the subsurface are greatest in the north- and south-central portions of Site 2. Samples of either soil or groundwater collected from locations SG2-6, -10, -11, -15, -16, -38, -39, and -40 all contained TVOCs at concentrations of 1,000 µg/L of air or greater. Samples quantified as non-detect are present along the northern, western, and northeastern edges of the sampling grid. To the south, concentrations of TVOCs in the subsurface decrease away from the central portion of the site toward the pond.

Soil gas detections of TVOCs were limited to five probehole locations (SG10, SG11, SG13, SG27, and SG29). These locations are near or hydraulically down-gradient of the FTA in Site 2. Soil gas TVOC concentrations range from 2 µg/l in SG11 to 22,472 µg/l in SG10. Detections of VOCs on the east side of Site 2 were limited to soil gas sample SG2-29 (31 µg/L of total 1,2 DCE). Soil gas, soil, and groundwater screening data suggest accurate location of the fire training burn area.

Sample #	Depth	Total VOC (µg/L)	Soil or Groundwater (higher value)
SG1	2	ND	
	4	ND	
SG3	9	ND	
SG4	9	ND	
SG6	10	75,002	Groundwater
SG7	9	ND	
SG8	9	ND	
SG10	10	53,445	Groundwater
SG12	10	54	Groundwater
SG14	5	481	Groundwater
SG15	10	12,879	Groundwater
SG16	10	10,751	Groundwater
SG17	10	ND	Groundwater
SG18	5	2	Groundwater
	10	88	Groundwater
SG19	10	8	Soil
SG21	10	ND	
SG22	10	ND	
SG23	1	ND	
	10	ND	
SG255	10	ND	
SG26	9	ND	
SG27	10	ND	
SG31	10	25	Groundwater
SG37	9	ND	
SG38	9	3,120	Soil
SG39	9	15,014	Groundwater
SG40	4	24,920	Soil



Explanation

- Previous road
- Surface water drainage
- Approximate downstream pond drainage
- Previous pond line
- Fence
- Groundwater screening sample
- Soil gas sample location
- Soil screening sample location
- Previous building
- Estimated location of Site 2
- TVOC soil and groundwater screening results contour (µg/l)

Approximate scale: 1"=100'

Source: 1129 Illinois DOT aerial photo

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Project No. 91-1657
183rd FG, Illinois ANG
Springfield, Illinois

Site 2 SOV Survey, Grab-Type Soil and Groundwater Screening Results - Total VOCs (µg/L)

Selected soil, sediment, surface water, and groundwater samples were collected from Site 2 and analyzed by either Pace or CompuChem Laboratories for VOCs, SVOCs, PCBs/Pesticides and TAL metals. A discussion of the analytical results for each medium is included in the following sections. Sample numbers and boring well, sediment and surface water locations are slightly different. An example of a soil sample number at Site 2 is CS2-SB2-0-0.5. This corresponds to location SB202, where CS2 is the location identifier (Capital Site 2), SB2 is the boring number and the 0-0.5 indicates the depth the sample was collected from. Sediment, surface, surface water, and groundwater samples follow similar numbering sequences.

3.7.3.1 Surface Soils

Eight surface soil samples were collected from locations SB202 through SB207 and SS201 and SS202. The soil analytical results for the surface soil samples are presented in Table 3-19. Figure 3-18 illustrates the sampling locations and provides a data summary and the results for the surface samples.

Volatile Organic Compounds

As illustrated in Figure 3-18, only methylene chloride was detected in the surface soils. It was found in samples SS201 and SS202 in concentrations of 10 and 18 $\mu\text{g/kg}$, respectively. These analytical results are consistent with the VOCs readings obtained during field GC screening and field PID readings obtained on these same samples.

Semivolatile Organic Compounds

Numerous SVOCs were detected at relatively low concentrations in the site surface soils. These include compounds from the PAHs, phthalate ester groups, and 1,4-DCB. The list of individual compounds included in the PAH and phthalate ester groups is included in Section 3.6.3. Figure 3-18 summarizes and illustrates the occurrences of SVOCs in the surface soils. Four surface soil samples collected from borings SB202, SB204, SB206, and SB207 contained total PAHs in concentrations ranging from 29 J (estimated) to 465 $\mu\text{g/kg}$. 1, 4-DCB was detected in three samples in concentrations ranging from 41 to 59 $\mu\text{g/kg}$. Phthalate esters were found in two samples in concentrations of 26 J (estimated) to 36 $\mu\text{g/kg}$.

Pesticides

Several pesticide compounds including dieldrin, heptachlor epoxide, eldrin, alpha- and gamma-chlordane were detected in surface soils collected from SB203 and SS202. Concentrations of these compounds range from 0.63 J (estimated) $\mu\text{g/kg}$ to 38 $\mu\text{g/kg}$.

Polychlorinated Biphenyls

Arochlor 1260, a PCB, was detected in surface soil samples from SB205 and SB206 in concentrations of 770 and 1200 $\mu\text{g/kg}$, respectively.

Inorganics

All of the TAL metals were detected in one or more surface soil samples collected from the site. Discussions regarding the presence or absence of inorganic contamination will be limited to compounds that exhibit appreciable toxicity. Table 3-20 lists these analytes, their range of

concentrations in the background surface and site surface soils, and the number of positive detections found in the surface soils. A review of the data presented on Table 3-20 shows seven metals present in site surface soils at concentrations greater than two times maximum background concentrations. These metals are arsenic (2.7 times background), barium (2.4 times background), calcium (14.3 times background), lead (27.2 times background), selenium (3.6 times background), thallium (9.2 times background), and zinc (3.2 times background). As presented on Table 3-9 the surface soil sample from SB205 shows the greatest evidence that these elevated concentrations of inorganics may be caused by contamination from a man-made source. This sample contains elevated arsenic (23 mg/kg), barium (404 mg/kg), lead (486 mg/kg) and zinc (201 mg/kg). Sample CS2-SB2-0-0.5 (location SB202) contains thallium at a concentration of 9 mg/kg. Lead was detected in concentrations exceeding the maximum background range in all but two of the eight surface soil samples. The distribution of lead in the surface soils at the site is illustrated in Figure 3-18.

3.7.3.2 Subsurface Soil Samples

Eight subsurface soil samples were collected from Site 2. Analytical results for these samples are presented in Table 3-21, and illustrated on Figure 3-19.

VOCs

2-butanone, 2-propanone (acetone), ethylbenzene, and xylenes (total) were detected in Site 2 subsurface soil samples. Detections from vadose zone soil samples consist of: 2-butanone (22 $\mu\text{g/kg}$) detected in the 2 to 4 ft sample collected from SB207, and 2-propanone (acetone) (300 $\mu\text{g/kg}$) detected in the 4.5 to 5 ft sample collected from the same boring. Detections from samples collected near the saturated zone consist of: ethylbenzene at 11,000 $\mu\text{g/kg}$ from the 4 to 5.5 ft sample in SB207; and total xylenes at 73,000 $\mu\text{g/kg}$ from the 4 to 6 ft sample in SB206, and at 1000 $\mu\text{g/kg}$ from the 4 to 5.5 ft sample in SB207. These higher concentrations of ethylbenzene and total xylenes, detected in soil samples collected near the saturated zone, correlate with the locations of higher field PID and GC readings. Ethylbenzene and total xylenes are typical components of JP-4.

SVOCs

SVOCs detected in Site 2 subsurface soils include 1,4-DCB, dibenzofuran, PAHs, and phthalate esters. 1,4-DCB and dibenzofuran were detected in three and one samples, respectively, at a maximum concentration of 100 $\mu\text{g/kg}$. Compounds from the phthalate ester group were detected in eight samples at concentrations ranging from 82 to 2170 $\mu\text{g/kg}$. Total PAHs were detected in two subsurface soil samples from locations SB206 and SB207 at 8,686 and 1,718 $\mu\text{g/kg}$, respectively. The PAHs detected in samples from SB206 and SB207 are common components of jet fuels and are associated with BTEX.

Pesticides

Relatively low concentrations (less than 1 $\mu\text{g/kg}$) of the pesticides dieldrin and heptachlor epoxide were detected in the 5.5 to 6 ft soil sample from boring SB202.

Polychlorinated Biphenyls

Arochlor-1260, a PCB, was detected in one sample from boring SB206. The PCB occurred at depths of 4 to 6 ft and was present in concentrations of 2,800 $\mu\text{g/kg}$.

Inorganics

Table 3-22 presents a summary table comparing the range of inorganic concentrations for site subsurface soils to their concentrations in the background subsurface soils. As illustrated on this table, very little evidence of elevated concentrations of inorganics exists in the subsurface soils. Although the maximum concentrations of arsenic, barium, cobalt, copper, manganese, nickel, silver, vanadium, and zinc are elevated above background concentrations, a majority of the metals are found at only 1 to 2 times the maximum background concentrations. Manganese (4.6 times background) and magnesium (7.7 times background) are the only analytes detected at greater than 2 times maximum background concentrations. The majority of elevated detections of inorganics are contained in soil samples analyzed from boring SB202. The distribution of lead in the subsurface soils is included on Figure 3-19. These data are included for comparison with Figure 3-18, which illustrates the lead distribution in the surface soils.

3.7.3.3 Sediment Samples

To determine if fire training activities have had an adverse impact on sediment quality in the pond, three sediment samples SD201 through SD203, were collected and analyzed for VOCs, SVOCs, pesticides/PCBs and TAL metals. The analytical results for the sediment samples are presented in Table 3-23 and summarized in Figure 3-18.

Organic Compounds

No VOCs, PCBs, or pesticides were detected in the sediment samples collected from the pond at Site 2. SVOCs were detected, however, 1,4-DCB was found in all sediment samples in concentrations ranging from 71 to 130 $\mu\text{g/kg}$. Phthalate esters were detected in two samples in concentrations of 230 and 310 $\mu\text{g/kg}$, while PAHs were detected in two samples at concentrations of 276 and 2,373 $\mu\text{g/kg}$.

Inorganics

Because background sediment samples could not be obtained at the site, a direct comparative determination of whether past fire training exercises have resulted in elevated concentrations of inorganics in the pond sediments is not possible. However, in general, inorganics detected in the pond sediment samples are not elevated significantly when compared to surface soil concentrations. Of the three samples, SD203 contains the highest concentrations of many of the more toxic metals. Because elevated concentrations of lead were detected so frequently in the site surface soils, the distribution of lead in the sediment samples is included on Figure 3-18. Lead concentrations range from 15.4 to 21.9 $\mu\text{g/kg}$ in the sediment samples, and from 9.3 to 17.9 $\mu\text{g/kg}$ in the background surface soil samples.

3.7.3.4 Surface Water Samples

Four surface water samples were collected from the pond at Site 2. Surface water samples SW201 through SW203 were collected from the same locations as sediment samples SW201 through SD203. SW204 is a field duplicate of SW203. The analytical results for the surface water samples are presented in Table 3-24 and summarized on Figure 3-20.

Organic Compounds

No organic compounds were detected in the surface water samples, and are therefore not presented on Table 3-24 and Figure 3-20.

Inorganic Compounds

In general, inorganic concentrations in the pond water samples are relatively low, particularly when this data set is compared to the site groundwater inorganic concentrations. Of the more toxic metals, aluminum, antimony, barium, chromium, lead, manganese, and nickel were detected in the surface water samples at the site.

Antimony was quantified in CS2-SW3 (SW203) at 14 $\mu\text{g/L}$. This concentration exceeds the federal MCL for antimony of 6 $\mu\text{g/L}$. No other samples tested positively for antimony, nor were any other analytes found to exceed any state or federal regulatory limits. Lead values, which are elevated in the surface soil samples are low, ranging from 1 to 2.1 $\mu\text{g/L}$.

3.7.3.5 Groundwater Samples

Two rounds of groundwater samples (December 1992 and April 1993) were collected from site monitoring wells (MW201, 202, and 203) by the methods described in Section 2.5.3.3. These samples were analyzed for VOCs, SVOCs, pesticides/PCBs, and TAL metals. The analytical results are presented in Table 3-25 and summarized in Figure 3-20.

Organic Compounds

Groundwater samples collected at the site show evidence of contamination by a variety of organic compounds, particularly VOCs (Table 3-25). Organic compounds detected within site groundwater samples include dichlorobenzene isomers, BTEX, chlorinated aliphatics (i.e., TCE), chloroform, chlorobenzene, methylene chloride, phthalate esters, and pesticides. The distribution of these compounds is illustrated on Figure 3-20. Monitoring well MW202, which is located between the pre-existing burn area and the pond, contains the greatest numbers and concentration of organic compounds. Well MW203, the up-gradient well, contains 1,2-DCB (0.56 $\mu\text{g/L}$ - second round) and diethyl phthalate (1J $\mu\text{g/L}$ - second round). Additionally, 4,4-DDT was quantified at 0.0028 $\mu\text{g/L}$ in MW201, the down-gradient well. The remaining compounds were detected in groundwater samples obtained from MW202. Compounds detected in both rounds of sampling from MW202 include chloroethane, (18.2 and 6.5 $\mu\text{g/L}$), di-n-butyl phthalate (0.8 and 1 $\mu\text{g/L}$) and vinyl chloride (76.5 and 78 $\mu\text{g/L}$). Benzene and toluene were detected in the April 1993 sampling event, but not in the December 1992 sampling. Organic compounds detected above state or federal regulatory limits include vinyl chloride (76.5 and 78 $\mu\text{g/L}$), and cis-1,2-DCE (74.00 $\mu\text{g/L}$). No PCBs were detected in the groundwater samples.

Inorganics

Inorganics were detected in the filtered and unfiltered groundwater samples collected from Site 2 monitoring wells. These results are presented in Table 3-25. Table 3-25 presents a summary of the metals concentrations in the filtered and unfiltered samples from site monitoring wells as compared to the analytical results obtained from MW203, the sites up-gradient monitoring well. Discussions regarding the presence or absence of inorganic contamination will be limited to inorganics that exhibit appreciable toxicity. As shown on Table 3-25 aluminum, arsenic, barium, beryllium,

chromium, cobalt, copper, iron, lead, manganese, nickel, vanadium, and zinc were quantified in concentrations exceeding concentrations obtained from MW203. Also, as illustrated in Table 3-25, many of the analytes are not detected in the filtered samples. As an example, no arsenic was detected in the filtered samples. Additionally, where an analyte is detected in the filtered samples its concentration is generally much lower than was quantified in the unfiltered sample. For example, barium was detected at a maximum concentration of 376 $\mu\text{g/L}$ in the unfiltered samples, but only at 127 $\mu\text{g/L}$ in the filtered sample. Samples from MW202 (the site monitoring well containing organic compounds) contained the highest concentrations of inorganics. Total lead was detected in this well at 25.6 $\mu\text{g/L}$. This concentration exceeds the federal MCL of 15 $\mu\text{g/L}$ and the ILEPA Class I groundwater standard of 7.5 $\mu\text{g/L}$. The distribution of lead at the site is included on Figure 3-20. In addition, manganese was detected in concentrations which exceed the federal MCLG. No other inorganics were detected in concentrations exceeding state or federal regulatory limits.

3.7.4 Conclusions

The occurrence and distribution of organic and inorganic compounds at Site 2 is complex. As such, a separate summary of site conditions is presented. The conclusions follow the presentation of the summary.

3.7.4.1 Summary

A variety of organic compounds and elevated concentrations of inorganics were found in the soils and groundwater at Site 2. Site 2 soils are clay and silt-rich. Groundwater occurs within these sediments at relatively shallow depths (from approximately 3 to 10 ft bgs) and flows south towards the pond and southeast off-site.

Construction of the aircraft parking apron immediately to the north of the site in 1989 changed the surface topography and drainage of the site considerably. No physical surface evidence of the old FTA exists. Boring and monitoring well locations were selected based on the results of the soil gas and grab-type soil and groundwater screening survey. These screening activities identified an area in the subsurface containing high VOCs at the same location base personnel had identified, prior to the survey, as the burn pit of the FTA.

Because of the construction activities, site surface and subsurface vadose zone soil appear to be comprised predominately of fill material. Soil contamination indicative of past fire training activities (i.e., unburnt or partially burnt fuel) has been identified in 2 soil borings; SB206 and SB207. Subsurface soils from these borings contain BTEX at 84,000 and 1210 $\mu\text{g/kg}$, respectively. No other surface or vadose zone soils contain BTEX. The distribution of BTEX in the subsurface is illustrated in Figure 3-21 and 3-22.

PCBs and metals, however, were detected in other soil samples. PCBs were found in surface and subsurface samples collected from borings SB205 and SB206 in concentrations ranging from 770 to 2800 $\mu\text{g/kg}$. Arsenic, barium, lead, thallium, and zinc were found in surface soils at concentrations greater than were detected in the background surface soil samples. In general, concentrations of inorganics in the subsurface soils are not elevated when compared to background subsurface soil results.

Sediment samples collected from the pond show evidence of contamination by PAHs (92 to 2373 $\mu\text{g/kg}$) and 1,4-DCB. Inorganics quantified in the sediment samples do not appear to be elevated when compared to SI surface soil background samples. Antimony was detected in one surface

water sample at 14 $\mu\text{g/L}$; this concentration exceeds the federal MCL for antimony. No other inorganics, particularly lead, appeared to be elevated.

The sites up-gradient well (MW203) and most down-gradient well (MW201) contain only minor amounts of organic compounds at a maximum concentration of less than 1 $\mu\text{g/L}$. However, MW202, which was installed closest to the potential source area, contains BTEX and a variety of other chlorinated and nonchlorinated VOCs. Vinyl chloride and cis-1,2-DCE were detected in concentrations exceeding state or federal ARARs. Inorganics, particularly lead, are elevated in the MW202 groundwater sample when compared to the concentrations quantified in the sites up-gradient well MW203. Total lead was detected in MW202 in concentrations exceeding federal and state ARARs. Iron and manganese were detected in a couple of monitoring wells exceeding ILEPA Class I Groundwater Standards.

3.7.4.2 Conclusions

As mentioned previously, screening activities identified an area in the subsurface containing high VOCs at the same location base personnel had identified prior to the survey, as the burn pit of the FTA. Construction activities have changed the surface topography and drainage at the site considerably. It is likely these activities involved the removal and addition of considerable amounts of fill material. The data presented here suggest a majority of the original soils present when the site was used as a FTA have been removed or disturbed during construction activities. This conclusion is supported by two lines of evidence:

- A considerable thickness of fill material (0 - 6.5 ft) was logged during drilling activities at the site. Fill thickness is also illustrated in Figure 3-21 and 3-22.
- Organic contaminants, particularly PAHs, are absent from the surface soils at the site. If the groundwater contamination present at the site is due to waste generated during past fire training exercises, burnt fuels or wastes sprayed or dumped on the ground surface must have infiltrated through the soil to reach the groundwater. If the original soils were still present at the site, residual contamination by non-volatile organic compounds would be expected to exist.

Alternatively, the lack of VOCs found within the soils may be due solely to volatilization of organics compounds from the soils. Inorganics, particularly lead, are elevated in surface soil samples and not elevated in the subsurface soil samples. A more random distribution of inorganics would be expected if fill material was used at the site.

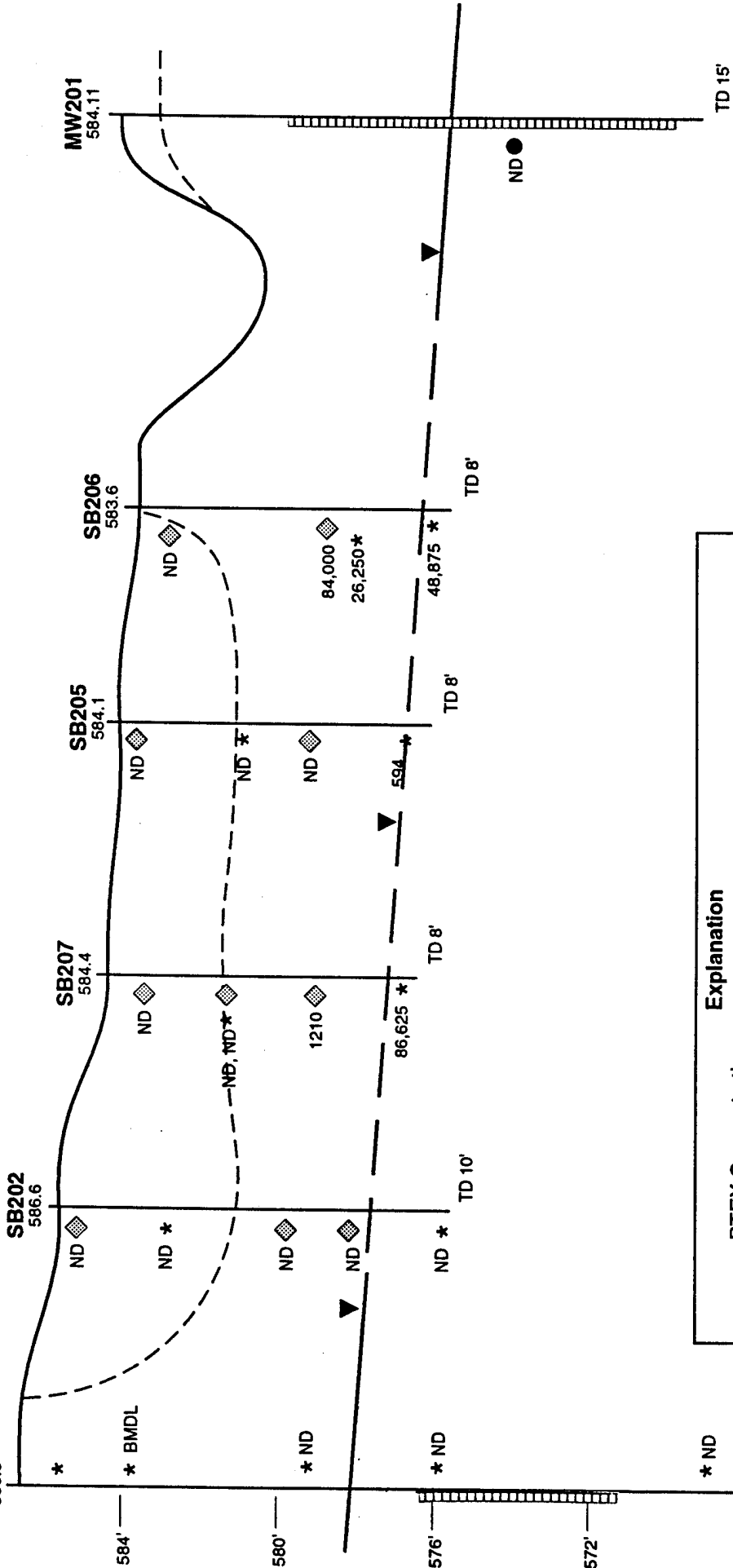
Groundwater samples contain BTEX and elevated inorganics. These findings correlate with the contaminants found within the site soils. Chlorinated aliphatics such as vinyl chloride are detected in groundwater collected from MW202, but are absent from the site soil samples.

A definitive source for the chlorinated aliphatics was not identified during this investigation. However, a review of the site screening results suggest that the VOC contamination may have originated at the location of the FTA. The presence of dense, non-aqueous phase liquids, which may degrade into vinyl chloride, suggests that contaminants may be migrating at depth within the saturated zone. If contaminants are migrating beneath the pond, they may be migrating off-site, toward the southeast. The data suggest that the chlorinated aliphatic compounds may have originated from wastes generated during fire training exercises. The data also supports the belief that the lack of



2A'

2A
SB201
PZ201
586.6



Feet above mean sea level

3-104

Explanation	
* BTEX Concentration - field GC analysis - soil	▼ Apparent water table (dashed where inferred)
◆ BTEX Concentration - fixed base soil analysis	--- Apparent depth of fill material (inferred)
● BTEX Concentration - fixed base groundwater sample	TD Total depth
ND Non detect	MW101 Well or boring number
BMDL Below Measurable Detection Limit	580.98 Ground elevation (MSL)
Screened interval	Horizontal Scale: 1" = 40'
	Vertical Scale: 1" = 4'
	Vertical exaggeration = 10x

Units are µg/l or µg/kg

The Earth Technology Corporation
Projed No. 91-1657
183rd FG, Illinois ANG
Springfield, Illinois

Site 2
Cross Section 2A-2A'
BTEX Concentrations

Figure 3-21

7-94

911657 X-Sec 2A

2B

SB204
586.5MW203
585.08SB207
584.4MW202
580.35

2B'

Feet above mean sea level

584'

580'

576'

572'

568'

564'

TD 8'

TD 8'

TD 15'

TD 13'

Benzene 5.63 µg/L
Total BTEX 34.24

Explanation

* BTEX Concentration -
field GC analysis - soil◆ BTEX Concentration -
fixed base soil analysis● BTEX Concentration -
fixed base groundwater sample

ND Non detect

BMDL Below Measurable Detection Limit

■ Screened interval

▼ Apparent water table
(dashed where inferred)--- Apparent depth of fill
material (inferred)

TD Total depth

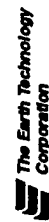
MW101 Well or boring number

580.98 Ground elevation (MSL)

Horizontal Scale: 1" = 40'

Vertical Scale: 1" = 4'

Vertical exaggeration = 10x



Project No.

183rd FG, Illinois ANG
Springfield, Illinois

91-1657

Site 2 Cross Section 2B-2B' BTEX Concentrations

7-94

Figure 3-22

4.0 PRELIMINARY RISK EVALUATION

The PRE was conducted to qualitatively assess potential public health and environmental threats associated with exposure to contaminants identified as part of the IRP being conducted at ILANG, Capital Airport.

The objectives of the PRE are to identify chemicals of potential concern, potential exposure pathways, potential ecological receptors, and any imminent threats posed by releases of hazardous materials at the sites. The PRE will be used to assist the determination of the need for corrective action or any further investigative efforts at the sites.

Section 4.1 presents the preliminary human health evaluation and Section 4.2 presents a preliminary ecological evaluation. Summaries and conclusions of the risk evaluation are presented in Section 4.3.

4.1 PRELIMINARY HUMAN HEALTH EVALUATION

The preliminary human health evaluation consists of identification of chemicals of potential concern (COPC), exposure assessment, toxicity assessment, and risk screening.

4.1.1 Identification of Chemicals of Potential Concern

This section evaluates the results of the sampling and analysis of environmental media at Site 1 and Site 2 at ILANG, Capital Airport for use in the PRE. Analytical data from the fixed-base laboratory have undergone QA/QC evaluation and summary statistics have been prepared using the validated data. The COPCs were identified for individual site medium because the two sites are located in separate areas and have difference physical characteristics.

4.1.1.1 Site 1: POL Storage Area

Tables 4-1 and 4-2 present the contaminant distribution for Site 1 surface (0 to 1 ft bgs) and subsurface soil, respectively. The distribution is compared to local background levels obtained during the SI. The contaminant distribution for groundwater is presented in Table 4-3. COPCs were identified based on the information contained in these tables and are discussed below. Identified ARARs are included on the tables for use in Section 4.3, Risk Screening. The ARARs were not, however, used to reduce the number of COPCs.

Lead was detected in the surface soil at levels above naturally occurring background levels. Levels in the subsurface soil were within background concentrations. Lead was detected in the groundwater at levels above ILEPA Class I groundwater standards and has been included as a COPC. However, lead values are not significantly elevated when compared to the sites up-gradient well.

Xylenes were detected in one surface and two subsurface soil samples. Methylene chloride and 2-propanone were detected at low levels. As shown in Table 4-3, very low levels of VOCs including benzene were detected in the groundwater. No attempt has been made to reduce the number of VOCs included as COPCs.

Table 4-1 Site 1 POL Storage Area Contaminant Distribution - Surface Soils
ILANG, 183rd FG, Capital Airport, Springfield, Illinois

	Frequency of Detection	Range of Detected Concentrations (µg/kg)	Range of Background Concentrations (µg/kg)	IEPA LUST Type A Soil Cleanup Objectives (µg/kg)
Methylene chloride	1 / 10	13.0 - 13.00	ND	
Xylenes (TOTAL)	1 / 10	9.0 - 9.00	ND	
Lead	9 / 9	14.9 - 53.90	9.3 - 17.9	7.5 ug/l (TCCLP)
1,4-Dichlorobenzene	4 / 10	48.0 - 100.00	ND	
Acenaphthene	1 / 10	24.0 - 24.00	ND	8400
Acenaphthylene	1 / 10	23.0 - 23.00	ND	4200 ¹
Anthracene	4 / 10	26.0 - 82.0	ND	42000
Benzo(a)anthracene	5 / 10	23.0 - 460.00	ND	2.6
Benzo(a)pyrene	6 / 10	24.0 - 490.00	ND	4.0
Benzo(b)fluoranthene	7 / 10	39.0 - 550.00	77.0 - 96.0	3.6
Benzo(g,h,i)perylene	4 / 10	37.0 - 140.00	ND	4200 ¹
Benzo(k)fluoranthene	2 / 10	33.0 - 640.00	77.0 - 96.0	3.4
Butyl benzyl phthalate	1 / 10	23.0 - 23.00	ND	
Carbazole	3 / 10	41.0 - 98.00	ND	
Chrysene	6 / 10	38.0 - 610.00	54.0 - 56.0	30
Di-n-butyl phthalate	5 / 10	21.0 - 50.00	ND	
Dibenzo(a,h)anthracene	2 / 10	98.0 - 190.00	ND	6
Diethyl phthalate	9 / 10	28.0 - 130.00	ND	
Fluoranthene	7 / 10	30.0 - 1100.00	110.0 - 120.0	5600
Fluorene	1 / 10	41.0 - 41.00	ND	5600
Indeno(1,2,3-c,d)pyrene	5 / 10	25.0 - 360.00	ND	8.6
Phenanthrene	5 / 10	32.0 - 550.00	51.0 - 55.0	4200 ¹
Pyrene	6 / 10	41.0 - 970.00	95.0 - 100.0	4200
bis(2-Ethylhexyl)phthalate	2 / 10	79.0 - 760.00	130.0 - 180.0	
Methoxychlor	1 / 2	5.6 - 5.60	1.3 - 1.3	

ND Not Detected

¹Type A soil cleanup objective is a total concentration of 4200 ug/kg for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.

Table 4-2 Site 1 POL Storage Area Contaminant Distribution - Subsurface Soils
ILANG, 183rd FG, Capital Airport, Springfield, Illinois

VOCs (µg/kg)	Frequency of Detection	Range of Detected Concentrations	Range of Background Concentration	IEPA LUST Type A Soil Cleanup Objectives
2-Propanone	1 / 9	30 - 30	120 - 120	
Methylene chloride	1 / 9	4 - 4	ND	
Xylenes (TOTAL)	2 / 9	9 - 9600	ND	
Inorganics (mg/kg)				
Lead	1 / 9	7.1 - 21.1	2.8 - 28.2	7.5*
SVOCs (µg/kg)				
1,4-Dichlorobenzene	6 / 9	34 - 75	ND	
2-Methylnaphthalene	2 / 9	210 - 590	ND	
Acenaphthene	2 / 9	23 - 35	ND	8400
Benzo(a)pyrene	2 / 9	24 - 33	ND	4.0
Benzo(b)fluoranthene	1 / 9	38 - 38	ND	3.6
Chrysene	2 / 9	38 - 41	ND	30
Di-n-butyl phthalate	6 / 9	20 - 48	ND	
Dibenzofuran	1 / 9	19 - 19	ND	
Diethyl phthalate	6 / 9	34 - 230	ND	
Fluoranthene	3 / 9	22 - 86	ND	5600
Fluorene	1 / 9	44 - 44	ND	5600
Naphthalene	2 / 9	230 - 230	ND	25
Phenanthrene	2 / 9	32 - 150	ND	4200 ¹
Pyrene	2 / 9	41 - 82	ND	4200
bis(2-Ethylhexyl)phthalate	1 / 9	460 - 460	120 - 160	

¹Type A soil cleanup objective is a total concentration of 4200 ug/kg for acenaphthylene, benzo(g,h,i)perylene, and phenanthrene.

* TCLP leachate concentration, ug/l
ND Not detected

Table 4-3 Site 1 POL Storage Area Contaminant Distribution - Groundwater
 ILANG, 183rd FG, Capital Airport, Springfield, Illinois

	Frequency of Detection	Range of Detected Concentrations ($\mu\text{g/l}$)	Background Concentration (MW2) ($\mu\text{g/l}$)	IEPA Class I Groundwater Standards ($\mu\text{g/l}$)	Federal Drinking Water MCL ($\mu\text{g/l}$)	AWQC Ingestion of Fish ($\mu\text{g/l}$)	AWQC Fresh Water Chronic Criteria ($\mu\text{g/l}$)
Inorganics							
Lead	3 / 10	5.1 - 9.4	7.3	7.5		50	3.2
SVOCs							
2,4-Dinitrotoluene	1 / 6	8 - 8				9.1	
2-Methylnaphthalene	1 / 6	3 - 3					
Di-n-butyl phthalate	2 / 6	0.6 - 1	0.5			154000	
Diethyl phthalate	1 / 6	2 - 2				1600000	
Naphthalene	2 / 6	3 - 11					620
VOCs							
1,2-Dimethylbenzene	1 / 3	0.69 - 0.7					
1,3-Dichlorobenzene	1 / 9	8.2 - 8.2			600	2600	763
1,3-Dimethylbenzene	1 / 1	1.6 - 1.6					
1,4-Dichlorobenzene	1 / 8	0.1 - 0.1		75	75	2600	763
1,4-Dimethylbenzene	1 / 1	0.17 - 0.2					
Benzene	1 / 6	0.74 - 0.7		5	5	40	5300*
Chlorobenzene	1 / 9	1 - 1		100			50
Chloroform	1 / 6	0.23 - 0.2	0.15		100**	15.7	1.24
Ethylbenzene	1 / 6	0.29 - 0.3		700	700	3260	32000*
Methyl-t-Butyl Ether	1 / 3	77 - 77					
Methylene chloride	2 / 6	0.17 - 0.7	0.47	5			
Styrene	1 / 3	0.44 - 0.4		100			
Toluene	1 / 6	1.1 - 1.1		100	1000	424000	17500*

* No chronic criteria available. Acute criteria used for comparison.
 ** No IEPA criteria available. Federal MCL used for total trihalomethanes.

SVOCs were detected in the surface and subsurface soils above background levels. These compounds are primarily PAHs and phthalate esters. PAH compounds typically occur together in the environment and are commonly associated with fuels. Naphthalene and 2-methylnaphthalene were the only PAHs detected in the groundwater. All detected SVOCs have been included as COPCs.

4.1.1.2 Site 2 - Former Fire Training Area

Tables 4-4 and 4-5 present the contaminant distribution for Site 2 surface (0 to 1 ft bgs) and subsurface soil. The distribution is compared to local background levels obtained during the SI. The contaminant distribution for groundwater is presented in Table 4-6. Surface water and sediment contaminant distributions are presented in Tables 4-7 and 4-8. COPCs were identified based on the information contained in these tables and are discussed below. Identified ARARs are included on the tables for use in Section 4.3, Risk Screening. The ARARs were not, however, used to reduce the number of COPCs.

Various metals were detected at levels greater than two times background in both surface and subsurface soil. Surface soil metal concentrations greater than two times the background surface soil concentration include arsenic, barium, lead, selenium, thallium, and zinc. Magnesium and manganese were detected at greater than two times background levels in the subsurface soils. Chromium, cobalt, copper, lead, manganese, vanadium, and zinc were detected in the groundwater at greater than two times background concentration. Low levels of metals were detected in the surface water, with higher levels seen in the sediment. All metals detected above two times background are considered COPCs. Those metals with known toxicity are also considered COPCs if they were detected at any level above background.

No VOCs, other than methylene chloride, were detected in the surface soil. Ethylbenzene and xylenes were detected at significant levels in the subsurface soil. 2-butanone and 2-propanone were detected in one sample. As shown in Table 4-6, various VOCs were detected in the groundwater. VOCs detected in the groundwater include elevated levels of 1,2-DCE, and vinyl chloride. No VOCs were detected in the surface water samples. No VOCs were detected in the sediment samples collected from the pond. All VOCs detected have been considered as COPCs.

Table 4-4 (Continued)

VOCs ($\mu\text{g/kg}$)	Frequency of Detection	Range of Detected Concentrations	Range of Background Concentration
Benzo(k)fluoranthene	1 / 9	46 - 46	77 - 96
Chrysene	4 / 9	29 - 60	54 - 56
Di-n-butyl phthalate	4 / 9	22 - 26	ND
Diethyl phthalate	2 / 9	14 - 14	ND
Fluoranthene	4 / 9	41 - 97	110 - 120
Indeno(1,2,3-c,d)pyrene	1 / 9	26 - 26	ND
Phenanthrene	4 / 9	27 - 39	51 - 55
Pyrene	5 / 9	29 - 110	95 - 100
bis(2-Ethylhexyl)phthalate	2 / 9	470 - 4300	130 - 180
Pesticides/PCBs ($\mu\text{g/KG}$)			
Aldrin	1 / 8	0.6 - 0.6	ND
Dieldrin	2 / 8	12 - 38	0.7 - 260
Heptachlor epoxide	2 / 8	5.1 - 5.5	17 - 57
PCB-1260	2 / 8	770 - 1200	ND
alpha-Chlordane	2 / 8	0.6 - 0.7	1 - 9.9
gamma-Chlordane	2 / 8	1.4 - 2.4	2.3 - 29

- * For elements which no detections were reported, background concentration is assumed to be the analytical detection limit.
 - ** The Contract Required Detection Limit is used as the value in the background concentration calculation where sample results were qualified "B" due to laboratory or field blank contamination.
 - ND Not Detected. Compound not expected to be present; therefore, no background concentration was calculated.
- 1) No Maximum Contaminant Level or action levels available.

Table 4-5 Old Fire Training Area Contaminant Distribution - Subsurface Soils⁽¹⁾
 Illinois Air National Guard, 183rd FG, Capital Airport, Springfield, Illinois

	Frequency of Detection	Range of Detected Concentrations	Range of Background Concentrations
VOCs (µg/kg)			
2-Butanone	1 / 9	22 - 22	ND
2-Propanone	1 / 9	300 - 300	120 - 120
Ethylbenzene	2 / 9	210 - 11000	ND
Xylenes (TOTAL)	2 / 9	1000 - 73000	ND
Inorganics (mg/kg)			
Arsenic	9 / 9	2.5 - 15.6	2.1 - 14.3
Barium	9 / 9	61.6 - 292	15.8 - 235
Beryllium	9 / 9	0.3 - 0.9	0.6 - 1
Calcium	9 / 9	2070 - 75100	534 - 3060
Chromium	9 / 9	13.9 - 23.4	4.2 - 23.1
Cobalt	7 / 9	6.4 - 33.3	6.2 - 17
Copper	6 / 9	12.2 - 31.9	6.5 - 17.5
Iron	9 / 9	16400 - 39000	4050 - 26500
Lead	9 / 9	13.5 - 23.8	2.8 - 28.2
Magnesium	9 / 9	3100 - 29300	699 - 3810
Manganese	9 / 9	150 - 9898	32.2 - 2100
Nickel	7 / 9	14.6 - 41.3	17.2 - 25.8
Potassium	9 / 9	875 - 2200	1230 - 1510
Silver	7 / 9	0.9 - 3.5	2.5*
Sodium	4 / 9	57.7 - 106	91.6**
Thallium	3 / 9	0.2 - 0.3	0.98*
Vanadium	9 / 9	20.6 - 41.9	9.3 - 37.5
Zinc	4 / 9	33.6 - 72.4	15.4 - 58.3
SVOCs (µg/kg)			
1,4-Dichlorobenzene	3 / 11	46 - 100	ND
2-Methylnaphthalene	2 / 11	910 - 2400	ND
Di-n-butyl phthalate	4 / 11	26 - 1200	ND
Dibenzofuran	2 / 11	30 - 170	ND
Diethyl phthalate	2 / 11	35 - 190	ND
Fluoranthene	3 / 11	25 - 49	ND

wp14-5.507-August 31, 1994

Table 4-5 (Continued)

	Frequency of Detection	Range of Detected Concentrations	Range of Background Concentrations
Fluorene	1 / 11	200 - 200	ND
Naphthalene	2 / 11	770 - 5300	ND
Phenanthrene	2 / 11	38 - 590	ND
Pyrene	1 / 11	150 - 150	ND
bis(2-Ethylhexyl)phthalate	5 / 11	78 - 970	120 - 160
Pesticides ($\mu\text{g/kg}$)			
Dieldrin	1 / 9	1 - 1	ND
Heptachlor epoxide	1 / 9	0.5 - 0.5	ND
PCB-1260	1 / 9	2800 - 2800	ND

ND= Not Detected. Compound not expected to be present; therefore, no background concentration was computed.
 * For elements which no detections were reported, background concentration is assumed to be the analytical detection limit.
 ** The Contract Required Detection Limit is used as the value in the background concentration calculation where sample results were qualified "B" due to laboratory or field blank contamination.
 1) No Maximum Contaminant Levels or action levels available.

Table 4-6 Old Fire Training Area Contaminant Distribution - Groundwater
ILANG, 183rd FG, Capital Airport, Springfield, Illinois

	Frequency of Detection	Range of Detected Concentrations ($\mu\text{g/l}$)	ILEPA Class			Federal Drinking Water MCLs ($\mu\text{g/l}$)	AWQC Ingestion of Fish ($\mu\text{g/l}$)	AWQC Fresh Water Chronic Criteria ($\mu\text{g/l}$)
			Background Concentration (MW3) ($\mu\text{g/l}$)	Groundwater Standards ($\mu\text{g/l}$)				
Inorganics								
Aluminum	6 / 8	69.4 - 43700	5260					
Arsenic	2 - 8	3.8 - 7.6	1.1	50	50	0.0175		50
Barium	6 / 8	134 - 376	258	2000	2000			
Barium, Dissolved	2 / 2	103 - 127	116	2000	2000			
Beryllium	1 / 8	1.7 - 1.7	1U - 2U		4	0.117		5.3
Calcium	4 / 8	87400 - 112000	109000					
Calcium, Dissolved	2 / 2	93600 - 100000	90000					
Chromium	2 / 8	29.2 - 55.5	9.2	100	100	3433000		210
Cobalt	3 / 8	8.9 - 23.9	2.8					
Copper	2 / 8	14.6 - 33.7	5.8	650	1300			12
Iron	6 / 8	782 - 39000	4450	5000	300*			1000
Lead	2 / 8	8.9 - 25.6	4.1	8		50		3.2
Magnesium	4 / 8	44300 - 62000	54000					
Magnesium, Dissolved	2 / 2	44000 - 52700	42400					
Manganese	8 / 8	17.5 - 3040	311	150		100		
Manganese, Dissolved	1 / 2	2510 - 2510	6705	150		100		
Nickel	2 / 8	9.1 - 33.7	2U - 31U		100			160
Potassium	2 / 8	3550 - 5100	1900					

wp/4-6.415-August 31, 1994

Table 4-6 (Continued)

	Frequency of Detection	Range of Detected Concentrations ($\mu\text{g/l}$)	ILEPA Class I			Federal Drinking Water MCLs ($\mu\text{g/l}$)	AWQC Ingestion of Fish ($\mu\text{g/l}$)	AWQC Fresh Water Chronic Criteria ($\mu\text{g/l}$)
			Background Concentration (MW3) ($\mu\text{g/l}$)	Groundwater Standards ($\mu\text{g/l}$)				
Sodium	2 / 8	10000 - 16400	8300					
Sodium, Dissolved	1 / 2	17300 - 17300	916U					
Vanadium	4 / 8	11.1 - 87.6	12.6					
Zinc	2 / 8	61.5 - 106	25.5	500				110
Pesticides/PCBs								
4,4'-DDT	1 / 4	0.003 - 0.003	ND			0.001	2.4E-05	
Endrin aldehyde	1 / 5	0.003 - 0.003	ND					
gamma-Chlordane	1 / 5	0.002 - 0.002	ND	2	2	0.00046	0.0043	
SVOCs								
Di-n-butyl phthalate	2 / 5	0.8 - 1	ND			154000		
VOCs								
1,2-Dichlorobenzene	1 / 11	0.63 - 0.63	0.56		600	26000	763	
1,2-Dichloroethane	2 / 8	2.1 - 2.7	ND	5	5	243	20000	
1,2-Dimethylbenzene	1 / 3	0.4 - 0.4	ND					
1,2-cis-Dichloroethylene	1 / 1	74 - 74	ND	0.07	0.07	1.85	11600*	
1,2-trans-Dichloroethylene	1 / 8	0.48 - 0.48	ND	100	100	1.85	11600*	
1,3-Dichlorobenzene	1 / 11	0.96 - 0.96	ND	600	600	2600	763	
1,4-Dichlorobenzene	1 / 11	1.5 - 1.5	ND	75	75	2600	763	
Benzene	1 / 7	0.45 - 0.45	ND	5	5	40	5300*	

wp/4-6.415-August 31, 1994

Table 4-6 (Continued)

	Frequency of Detection	Range of Detected Concentrations ($\mu\text{g/l}$)	ILEPA Class I			Federal Drinking Water MCLs ($\mu\text{g/l}$)	AWQC Ingestion of Fish ($\mu\text{g/l}$)	AWQC Fresh Water Chronic Criteria ($\mu\text{g/l}$)
			Background Concentration (MW3) ($\mu\text{g/l}$)	Groundwater Standards ($\mu\text{g/l}$)				
Benzyl Chloride	1 / 3	24.97 - 24.97	ND					
Chlorobenzene	1 / 11	0.18 - 0.18	ND					50
Chloroethane	4 / 8	6.5 - 18.2	ND					
Chloroform	2 / 8	0.076 - 3.1	ND		100	15.7	1.24	
Ethylbenzene	1 / 7	26.01 - 26.01	ND	700	700	3260	32000*	
Methylene chloride	2 / 8	1.6 - 1.7	ND					
Tetrachloroethylene	1 / 8	54.1 - 54.1	ND		5	0.65	640	
Toluene	1 / 7	0.91 - 0.91	ND	100	1000	424000	17500*	
Trichloroethylene	3 / 8	1.4 - 3	ND	5	5	80.7	21900	
Vinyl chloride	5 / 8	48.5 - 78	ND	2	2	525		

* No chronic criteria available. Acute criteria used for comparison.

U = Non Detect (Quantitation limit).

ND Not Detected - Compound was not expected to be present; therefore, no background concentration was calculated.

Table 4-7 Site 2 Old Fire Training Area Contaminant Distribution - Surface Water
ILANG, 183rd FG, Capital Airport, Springfield, Illinois

	Frequency of Detection	Range of Detected Concentrations (µg/l)	ILEPA Class I Groundwater Standards (µg/l)	AWQC Ingestion of Fish (µg/l)	AWQC Fresh Water Chronic Criteria (µg/l)
VOCs					
1,4-Dichlorobenzene	1 / 4	2.1 - 2.1	75	2600	763
Inorganics					
Aluminum	4 / 4	200 - 224			
Antimony	1 / 4	14 - 14		45000	1600
Barium	4 / 4	69.3 - 77.3	2000		
Barium, Dissolved	4 / 4	67.7 - 77.3	2000		
Calcium	4 / 4	200 - 75300			
Calcium, Dissolved	4 / 4	1700 - 75800			
Chromium	1 / 4	4.6 - 4.6	100	3433000	210
Lead, Dissolved	2 / 4	1 - 2.1	8	50	3.2
Magnesium	4 / 4	600 - 38200			
Magnesium, Dissolved	4 / 4	800 - 32300			
Manganese	4 / 4	35.3 - 48.6	150	100	
Manganese, Dissolved	4 / 4	27.6 - 42.8	150	100	
Nickel, Dissolved	2 / 4	3.4 - 5.6		100	160
Selenium	1 / 4	1 - 1	50		
Selenium, Dissolved	1 / 4	1.1 - 1.1	50		
Sodium	4 / 4	7770 - 8750			

Table 4-8 Site 2 Old Fire Training Area Contamination Distribution - Sediments⁽¹⁾
ILANG, 183rd FG, Capital Airport, Springfield, Illinois

Inorganics (mg/kg)	Frequency of Detection	Range of Detected Concentrations
Aluminum	3 / 3	7350 - 17700
Arsenic	3 / 3	2.6 - 6.7
Barium	3 / 3	59.9 - 335
Beryllium	3 / 3	0.4 - 0.8
Calcium	3 / 3	5580 - 64300
Chromium	3 / 3	10.5 - 32.6
Cobalt	3 / 3	5.4 - 16.4
Copper	3 / 3	8.9 - 26.5
Iron	3 / 3	10200 - 53400
Lead	3 / 3	15.4 - 21.9
Magnesium	3 / 3	3630 - 8080
Manganese	3 / 3	321 - 3680
Nickel	3 / 3	11 - 3705
Potassium	3 / 3	852 - 2170
Silver	1 / 3	4 - 4
Sodium	3 / 3	81.5 - 166
Vanadium	3 / 3	18.3 - 59.6
Zinc	3 / 3	31.5 - 72.6
SVOCs (µg/kg)		
1,4-Dichlorobenzene	3 / 3	71 - 130
Anthracene	1 / 3	43 - 43
Benzo(a)anthracene	1 / 3	190 - 190

Table 4-8 (Continued)

	Frequency of Detection	Range of Detected Concentrations
Benzo(a)pyrene	1 / 3	240 - 240
Benzo(b)fluoranthene	1 / 3	190 - 190
Benzo(k)fluoranthene	1 / 3	290 - 290
Chrysene	1 / 3	250 - 250
Diethyl phthalate	2 / 3	230 - 310
Fluoranthene	2 / 3	46 - 350
Indeno(1,2,3-c-d)pyrene	1 / 3	130 - 130
Phenanthrene	1 / 3	200 - 200
Pyrene	2 / 3	46 - 490

1) No MCLs or action levels available.

SVOCs, primarily as PAHs, were detected in the surface soil, but are generally within background concentrations. PAHs appear to exist in the surface soils throughout the base and SAA property. Elevated levels of PAHs were detected in several subsurface soil samples. Phthalates were also detected in the surface and subsurface soil. No SVOCs were detected in the surface water. Di-n-butyl phthalate was detected at low levels and frequencies in the groundwater. PAHs, phthalates, and 1,4 dichlorobenzene were detected in the pond sediment samples. All PAHs detected have been identified as COPCs.

PCB/Pesticides were detected in the surface and subsurface soils at low frequencies. Low levels of pesticides were detected in the groundwater. No PCBs/pesticides were detected in the surface water or sediment.

4.1.2 Exposure Assessment

This exposure assessment evaluates the potential for human exposure to contaminants present at, or released from, Sites 1 and 2. An overview of general site conditions is presented, potentially exposed populations are discussed, and potential complete exposure pathways are identified.

4.1.2.1 Characterization of Exposure Setting

Site 1 – POL Storage Area

Site 1 – POL Storage Area is located on the northwest side of the base. The area contains four USTs with associated pumps and piping. The immediate area is heavily grassed with concrete drives for refueling and offloading. The surrounding area is primarily grass. The base operations building is directly across the road from Site 1. The POL Storage Area is scheduled to be moved to a new location. The existing USTs will be removed at that time. The base has indicated that the Site 1 area will be paved with concrete and used as an aircraft parking apron. The site is located in a secured area with limited access.

The soils underlying the site are clay-and-silt rich. A layer of fill or reworked clay-rich native soil exists in the upper few ft of the site. On the north side of the UST pit a thin silt layer is present.

The water supply for the base is municipal water. The supplied water is withdrawn from Lake Springfield, which is located approximately five miles southeast of the airport. No potable water wells have been drilled on the base property.

The depth to shallow groundwater at the site is less than 10 ft from the ground surface. Groundwater direction is toward the south-southwest. Down-gradient residential wells are however, located within approximately one mile of the site.

The nearest surface water body is an unnamed tributary of Spring Creek located approximately 1,500 ft from the eastern boundary of the base. Surface water runoff from the base flows toward the tributary. Direct contamination of this water body from groundwater at Site 1 is unlikely since the groundwater flow direction is to the southwest. It is possible however, that the groundwater could intercept the storm sewer system in the immediate vicinity of Site 1 and impact the surface water through this migration route. The most likely migration route would be through the backfill of the storm sewer system. The storm sewer system, as illustrated in Figure 3-2, is approximately five ft bgs, and the depth to groundwater is approximately 6.5 ft.

Site 2 – Old Fire Training Area

Site 2 – FTA is located on SAA property, east of the approach end of Runway 36 and north of a small pond and intermittent stream. The FTA and the surrounding property has been extensively regraded. Part of the property area is now a concrete parking apron. The pond location appears to have been altered somewhat due to construction activities. Off-site are seven residences, with wells and ponds. The site is inside a 8-ft high chain-linked fence. Access to the site is strictly controlled by the SAA.

Fill material predominates in the upper soil profile. Fill material, where present, overlies native clay soils. A silt layer exists in the central and eastern portions of the site.

The water supply for the SAA is municipal water which is supplied from Lake Springfield, located approximately five miles southeast of the airport. No potable water wells have been installed at the SAA. The closest downgradient residential well is approximately 400 to 500 ft from the FTA. Groundwater at Site 2 is generally within 10 ft of the ground surface. Groundwater flow direction is toward the southeast. Residential wells are located less than a quarter of a mile downgradient of the FTA. These wells are reportedly drilled from 15 to 50 ft deep. The seven residences located down-gradient of Site 2 have been connected to the municipal water source, and their wells were abandoned in the spring of 1994.

A surface runoff pond is located at Site 2. This pond collects runoff from the runways. The pond drains to an intermittent stream or drainage swale, which, drains to a low lying area. The intermittent stream is the source of water for several residential ponds.

4.1.2.2 Exposure Pathways

Exposure pathways are evaluated based on COPCs, migration pathways of COPCs, and location of potential receptors. A summary of identified exposure pathways is presented in the following paragraphs.

Site 1 – POL Facility

Exposure to Contaminated Soil

Access to the base is controlled and restricted to base personnel and maintenance workers. Workers may be exposed to surface soils during routine maintenance activities and control of vegetation at the site. Exposure is seasonal and infrequent. Exposure pathways of COPCs include incidental ingestion and dermal absorption of COPCs from surface soils.

Workers may be exposed to subsurface soils in the future should any excavation activities take place at the site. Exposure durations are expected to be brief and infrequent. Exposure pathways of COPCs include dermal absorption and incidental ingestion of COPCs from subsurface soil and inhalation of VOCs and particulates.

Exposure to Contaminated Groundwater

The base receives drinking water from the city of Springfield municipal water supply and there is no groundwater use on the base. Because residential wells are located down-gradient of the site, exposure to groundwater contaminants could occur if the shallow groundwater migrates off-site and impacts potable wells. The nearest surface water bodies are up-gradient of the site. However, the groundwater could potentially intercept the storm sewer system. Based on this SI, contamination from Site 1 has not migrated off-site. If down-gradient wells were impacted, potential exposure pathways would be ingestion of COPCs and dermal absorption of COPCs through washing and bathing and inhalation of VOCs through showering or bathing.

Exposure to Surface Water Contamination

Surface water runoff of surface soils at Site 1 is a potential migration pathway. If surface water were impacted, potential routes of exposure would be those related to recreational activities, such as ingestion of COPCs and dermal absorption of COPCs while swimming.

Site 2 - Former Fire Training Area

Exposure to Soil Contamination

The SAA is a controlled area which restricts access to the FTA. Workers may be exposed to surface soil during outdoor activities at the site. Exposure frequency would be seasonal and infrequent. Exposure pathways include incidental ingestion of COPCs and dermal absorption of COPCs from surface soils.

Exposure to subsurface soil contamination could occur during any excavation activities in the area. Exposure would be brief and infrequent. Exposure pathways are similar to those identified for surface soil exposure.

Exposure to Groundwater Contamination

The airport receives drinking water from the city of Springfield municipal water supply and there is no groundwater use on-site. There are residential wells located down-gradient of Site 2. Migration of contaminated groundwater, off-site beneath the pond, is possible. However, current data does not enable conclusive characterization of this possibility. If off-site downgradient wells were impacted, potential routes of exposure would include ingestion of drinking water contaminated with COPCs, dermal absorption of COPCs through washing and bathing, and inhalation of VOCs while showering.

Exposure to Surface Water Contamination

A surface water runoff pond is present at Site 2. This pond drains into an intermittent stream which is the water source for nearby residential ponds. Surface water runoff from the soils at Site 2 may impact the surface water runoff pond. The contaminants present in the surface soils, primarily lead

and PCBs, are likely to remain in the soils, based on the TCLP analysis performed and the characteristics of the contaminants. The surface water data collected during the SI supports these conclusions. Eroded contaminated soil may be deposited downstream, especially in residential ponds that will act as settling basins.

The groundwater may be an additional source of surface water contamination. The pond may be fed by shallow groundwater in addition to surface runoff. The SI data indicates that shallow groundwater may be discharging to the pond. If the off-site ponds are impacted, potential routes of exposure would include ingestion of COPCs in surface water, and dermal absorption of COPCs swimming. The ponds are reportedly stocked with fish. Exposure pathways include ingestion of contaminated fish.

Exposure to Contaminated Sediments

On-site exposure to contaminated sediments may occur if the surface water runoff pond is removed during future construction activities. Exposure duration would be brief. Exposure pathways include dermal contact and accidental ingestion of COPCs. Off-site exposure to contaminated sediments may occur if down-gradient ponds have been impacted by Site 2 runoff.

4.1.3 Toxicity Assessment

Because no quantitation of risk is being performed as part of this SI, no toxicity values have been included.

Although many chemicals are either known or suspected to cause cancer in humans, there are varying degrees of confidence in the weight of evidence for carcinogenicity of a given chemical. EPA's weight of evidence classification includes the following five categories:

Group A - Known Human Carcinogen

Group B - Probable Human Carcinogen, based on human epidemiological studies (Group B1) or evidence of carcinogenicity in animals (Group B2)

Group C - Possible Human Carcinogen

Group D - Not Classified

Group E - Evidence of Non-Carcinogenicity to Humans

The weight of evidence classification for carcinogenicity for the COPCs identified as Group A, B, or C has been included in Table 4-9, along with the drinking water concentration which would cause a 10^{-4} cancer risk. Generally, a cancer risk is considered unacceptable if risk exceeds a range of 10^{-4} .

Table 4-9 Carcinogenic Classification and Cancer Risk Estimates
ILANG, 183rd FG, Capital Airport, Springfield, Illinois

ANALYTE	Intake (10^{-4} Cancer Risk) $\mu\text{g/l}$	Cancer Classification
1,4-Dichlorobenzene		C
2,4-Dinitrotoluene	5	B2
Aldrin	0.2	B2
Arsenic	2	A
Benzene	100	A
Benzo(a)anthracene		B2
Benzo(a)pyrene		B2
Benzo(b)fluoranthene		B2
Benzo(k)fluoranthene		B2
Beryllium	0.8	B2
Butyl benzyl phthalate		C
Chloroform	600	B2
Chrysene		B2
Dibenzo(a,h)anthracene		B2
Dieldrin	0.2	B2
Heptachlor epoxide	0.4	B2
Indeno(1,2,3-c,d)pyrene		B2
Lead		B2
PCB-1260		B2
Stryene		C
Tetrachloroethylene	70	B2
Vinyl chloride	1.5	A
alpha-Chlordane	3	B2
bis(2-Ethylhexyl)phthalate	300	B2
gamma-Chlordane	3	B2

4.1.4 Risk Screening

For this PRE, the risk screening consists of a comparison of environmental concentrations with existing state and federal criteria and standards.

ARARs for this PRE include: National Drinking Water Regulations, EPA Health Advisories, Illinois EPA Class I Groundwater Standards, ILEPA LUST Type A Soil Cleanup Objectives (Site 1 only), and Ambient Water Quality Criteria (AWQC) for ingestion of fish and protection of aquatic life. A comparison of contaminant concentrations with existing standards was presented earlier in Tables 4-1 through 4-8.

4.1.4.1 Site 1 - POL Storage Area

Lead present in the soil will tend to remain adsorbed to the soil, rather than leaching to the groundwater, as based on the TCLP results. The xylenes (total) concentrations present in the soil are below the 10,000 ppb ILEPA cleanup objective for ILEPA Type A soils. Naphthalene is present in two samples at 230 ppb, above the 25 ppb ILEPA clean up objective. The remaining non-carcinogenic PAHs are within the Type A cleanup objectives. Carcinogenic PNAs are above the ILEPA Type A soil cleanup objectives. The soil may require remediation to reach the cleanup objectives.

Two rounds of groundwater sampling were performed at the site. VOC and SVOC concentrations present in groundwater do not exceed ILEPA or federal groundwater standards. The ILEPA Class I groundwater standard for lead of 7.50 $\mu\text{g/L}$ was exceeded in one total lead sample (9.40 $\mu\text{g/L}$), but was below detection limits in the corresponding dissolved sample.

4.1.4.2 Site 2 - Old Fire Training Area

No ARARs for soil have been promulgated by the ILEPA. Based on the TCLP analysis performed on-site 2 samples, the metals present in the soils at the site indicate no significant potential for release to the groundwater. Ethylbenzene and xylene present in the subsurface soils are expected to exhibit more mobility than metals through the soils, and thus exhibit a greater potential for release to the groundwater. The SVOCs detected in the soils are expected to adsorb into the soil and not leach to a great extent to the groundwater.

No PAHs were detected in the groundwater. Cis 1,2-DCE and vinyl chloride were detected at levels above ILEPA and federal drinking water standards. Vinyl chloride is a carcinogen. Total lead was detected in two samples above the ILEPA Class I groundwater standard of 7.50 ppb. Dissolved lead was not detected in any sample. Pesticides were detected at levels above the ILEPA Class I standard. DDT and chlordane are Class B2 carcinogens.

The surface water concentrations were compared to the ILEPA Class I drinking water standards as a conservative estimate of risk. All compounds detected are within these standards. As a worst-case scenario, the groundwater concentrations and surface water concentrations in the runoff pond have been compared to the AWQC for fish consumption for an estimate of the risks associated with the residential ponds. This scenario assumes the concentration of contaminants in the residential pond is identical to the contaminant concentration in the surface water pond or groundwater. Arsenic, beryllium, 1,2 DCE, DDT and gamma-chlordane are above the levels considered protective for fish consumption under this scenario.

4.2 ECOLOGICAL RISK EVALUATION

This subsection provides a preliminary evaluation of risks to the natural environment posed by chemicals in environmental media at Site 1 and Site 2. This information, in conjunction with the preliminary human health evaluation and other information presented in the SI report, will be used to assist in the determination of appropriate future action at the base.

This qualitative ecological PRE includes a summary of analytical data used in the evaluation, identification of potential ecological receptors and pathways, ecotoxicity assessment, and an ecological hazard assessment.

4.2.1 Summary of Analytical Data Used in the Ecological PRE

Site 1 - POL Storage Area

Surface, subsurface, and groundwater samples were collected at Site 1. Surface soil contamination at Site 1 consists primarily of PAHs and lead. No VOCs were detected at elevated levels. PAHs and xylenes are the primary contaminants in the subsurface soils. Low levels of SVOCs, lead, and VOCs were detected in the groundwater. The distribution of contaminants was presented previously in Tables 4-1 through 4-3.

Site 2 - Old Fire Training Area

Surface and subsurface soils, surface water, sediment, and groundwater samples were collected at Site 2. Surface soils at Site 2 contain PAHs and metals above background levels and detections of Pesticide/PCBs at low frequencies. Subsurface soils contain primarily VOCs and PAHs. Sediment samples contain SVOCs, while surface and groundwater contain primarily VOCs. The distribution of contaminants was previously presented in Tables 4-4 through 4-8.

4.2.2 Identification of Potential Receptors

4.2.2.1 Site 1 - POL Storage Area

No surface water bodies exist at Site 1. Surface drainage flows into a storm drain system. The outfall of this system is an unnamed tributary of Spring Creek and is located 1500 ft from the eastern boundary of the base. The potential exists for the groundwater to intercept the storm system at Site 1 because the depth of the storm sewer is approximately 5 ft and the depth to groundwater is approximately 6.5 ft. The immediate area of Site 1 is composed of grass and concrete. No vegetation, other than turf grass is present at the Site. Ecological receptors are expected to include terrestrial anthropoids such as insects and spiders and small mammals such as the meadow mole. Migratory birds may be occasional visitors to the site.

The Spring Creek tributary is expected to be used by small mammals and birds. It is not known if fish are present in the stream. Although unlikely, these receptors could be exposed to groundwater contamination from Site 1, if the groundwater intercepts the storm sewer and discharges to the creek.

4.2.2.2 Site 2 - Old Fire Training Area

A surface runoff pond is located at Site 2, which is on SAA property. This runoff pond drains into an intermittent stream which is a water source for nearby residential ponds. The runoff pond appears to be fed by groundwater in addition to surface runoff. Ground cover in the immediate area surrounding Site 2 is low maintenance grass. A concrete parking apron is adjacent to the site. Terrestrial organisms which may use this area include primary consumers, such as mice and seed eating birds; predators, such as foxes, garter snakes, lizards, and rabbits; and omnivores, such as crows, starlings, and opossums. No aquatic organisms were identified in the surface water runoff pond. The residential ponds are stocked with fish.

4.2.3 Ecological Exposure Pathways

Aquatic and terrestrial organisms may be exposed to chemicals in environmental media via several pathways. Aquatic organisms may be exposed via direct contact with, including ingestion of, surface water and sediment, as well as consumption of contaminated aquatic plants. Terrestrial organisms may be exposed to chemicals via ingestion of and/or dermal contact with surface soils, as well as through the food chain.

4.2.3.1 Site 1 - POL Storage Area

No surface water bodies are present at Site 1 and no known aquatic receptors exist at the base. Contaminants present in the upper two feet of subsurface soils could present a threat to any terrestrial organisms which consumed the grass. The chemicals present in the subsurface soils are generally tightly sorbed to the soil and leaching of the contaminants for uptake by the plants is not considered a significant pathway. Terrestrial organisms could be exposed to surface soil chemicals through ingestion of and/or dermal contact with surface soils.

If the storm water system was intercepted by the groundwater at Site 1, the creek receiving the storm water runoff could provide a pathway for exposure of contaminated groundwater to aquatic organisms and small mammals and birds, as described previously. The creek is up-gradient from the site and no potential exists for the groundwater to directly enter the creek except by migration through the backfill of the storm drain.

4.2.3.2 Site 2 - Old Fire Training Area

Terrestrial organisms may come into contact with surface soils at Site 2 through ingestion of and dermal contact with surface soils. Contact with subsurface contaminants may occur through the consumption of vegetation and burrowing. The metals and SVOCs present in the soil will tend to adsorb strongly and not leach to a significant extent as indicated by the TCLP analysis performed on-site 2 soil samples (see Appendix J).

Contact with groundwater may occur through the ingestion of surface water which is fed by groundwater. Fish in the residential ponds may be exposed directly by ingestion of contaminated sediments or indirectly by consumption of contaminated invertebrates living in the sediments.

4.2.4 Ecological Hazard Assessment

This section qualitatively characterizes the risk to aquatic and terrestrial receptors potentially exposed to chemicals at Sites 1 and 2. The concentrations detected in the groundwater at each site have been compared to the AWQC protective of aquatic life. The soil concentrations detected at the sites have been compared to the available TCLP leachate data as an indication of the concentration available for plant uptake.

Site 1 - POL Storage Area

The ecological hazard associated with the soils at Site 1 is considered small. The chemicals present in the soils are tightly bound and are unlikely to leach to a significant degree for plant uptake. Terrestrial receptors present at the site may be exposed by incidental ingestion of soil

The potential risk to plants and animals from the groundwater is also considered to be low because the pathway is probably incomplete. The SI data indicate little contamination in the groundwater at the present time, and the impact on the surface water, if any, is considered minimal. Contaminants present in the groundwater are within levels considered protective of aquatic life. If they were released to surface water in an undiluted form they would not present a risk to aquatic organisms.

Site 2 - Old Fire Training Area

The hazard associated with the soils at Site 2 is considered to be low. The contaminants present at the Site will not readily leach and become available for plant uptake, based on the results of the TCLP analysis.

Copper, lead, DDT, and gamma chlordane are present in the groundwater at levels above those considered protective of aquatic life. The levels detected in the Site 2 surface water runoff pond are below AWQC criteria.

4.3 SUMMARY OF THE PRELIMINARY HUMAN HEALTH AND ECOLOGICAL EVALUATION

Site 1 - POL Storage Area

Contaminants detected at Site 1 considered to be of potential concern include VOCs, SVOCs, and lead. The contaminants present in the groundwater are at low concentrations and have not migrated off-site. Additionally, contaminant concentrations in the groundwater do not exceed ARARs. Based on this evaluation, there does not appear to be any immediate threats to human health.

The levels of PAHs present in the soil are above the LUST ILEPA Type A cleanup objectives, indicating that remediation may be required. Potential exposure may occur during these remedial activities. Potential exposure of on-site construction workers may also occur during removal of the USTs.

No screening criteria are available to assess the risk of the site to terrestrial ecological receptors. The levels of contaminants detected in the groundwater are within the range considered to be protective of aquatic life if discharged directly to surface waters.

Future exposure of human receptors to contaminated groundwater may occur if contaminants migrate to off-site wells, several of which are down-gradient of the site. Current contaminant concentrations in groundwater are within ILEPA Class I standards.

Site 2 - Old Fire Training Area

Contaminants detected at Site 2 and considered to be COPCs include metals, VOCs (particularly cis 1,2-DCE and vinyl chloride), PAHs, and pesticides. The down-gradient monitoring well installed at the site indicates groundwater contamination. If there is an additional flow component underneath the pond, then the site may pose an immediate threat to the off-site drinking wells, due to the presence of vinyl chloride at greater than 10 times federal MCLs, and ILEPA Class I groundwater standards. Groundwater concentrations for vinyl chloride could cause greater than 10^{-4} cancer risk.

Surface soil may be a point of exposure during site excavation activities. The metals and PAHs present in the soils pose no threat which would necessitate immediate action. Potential exposure to contaminated soils may occur in the future during excavation activities.

Ingestion of contaminated fish is a potential pathway and preliminary screening indicates that a health risk may be present, if groundwater impacts the residential ponds. It is not known what risk is present from the pond sediments.

Ecological risk from Site 2 is minimal from soils due to the nature of the soil contaminants present. The level of contaminants in the surface water pond does not pose an immediate threat from ingestion. The screening process did indicate that a potential risk may exist for aquatic life if the groundwater impacts the residential ponds.

Based on both the human health and ecological components of the PRE, additional data are necessary to completely characterize the risks associated with Site 2.

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

An SI has been conducted under the IRP at the 183rd FG, ILANG, Capital Airport, Springfield, Illinois. Field investigations supporting the SI ran from November 1992 to April 1993 and consisted of data gathering to:

- Confirm the presence or absence of environmental contamination at the sites under investigation, and if possible, define the nature and extent of the environmental contaminants.
- Qualitatively evaluate the potential risks to human health and the environment.

Field screening and confirmation/delineation activities included analysis of soil gas, surface and subsurface soils, sediment, surface water and groundwater samples, and the collection of geologic and hydrogeologic descriptions and measurements. The summary, conclusions, and recommendations obtained from the SI activities are included in the following.

5.1 SUMMARY AND CONCLUSIONS

Two sites were investigated during this SI; Site 1 – POL Storage Area, and Site 2 – FTA. This section presents a summary of the data collected for each site and the conclusions reached during the investigation. The results of the qualitative risk evaluation are included in this summary.

5.1.1 Geology and Hydrogeology

The geologic units investigated during the field activities are the clay- and silt-rich sediments of the Pleistocene-aged glacial tills underlying Central Illinois. Bedrock beneath the base consists of Pennsylvanian-aged sedimentary rock. The glacial sediments are from 21.5 to 26 ft thick and generally consist of an upper and lower clay unit. Between the clay units a thin silt unit is sometimes present in the subsurface. Groundwater occurs within the shallow aquifer at depths ranging from approximately 3 to 9.5 ft. Groundwater flow directions are to the southwest at Site 1 and to the south and southeast at Site 2. Average hydraulic conductivities for Sites 1 and 2, as measured by aquifer slug testing, are 1.35×10^{-4} cm/sec and 1.73×10^{-4} cm/sec, respectively.

5.1.2 Quality Assurance/Quality Control

A detailed QA/QC program was instituted to ensure the sampling and analysis conducted during the SI were representative of the sites under investigation. A review of these procedures and the control data indicate, in general, the objectives outlined by the PARCC parameters have been met. However, some samples failed to meet required QA criteria. Several samples failed the required laboratory QC requirements which resulted in the validation of affected compounds as R, indicating unreliable data. Several compounds detected in trip, equipment, and laboratory blanks may be attributed to sample handling, transportation, storage or analytical procedures. The presence of these compounds does not adversely affect the usefulness of the associated analytical data. However, significantly high levels of lead and arsenic were detected in the potable water field blank sample which invalidated a majority of the corresponding positive analytical detections obtained from the second round of groundwater sampling. No other blank analysis had a significant impact on data usability.

5.1.3 Site 1: POL Storage Area

Soil and groundwater contamination was detected by the screening and confirmation sampling and analysis conducted at the site. BTEX compounds are generally absent from the surface and vadose zone soil samples. Of the 17 soil samples collected and submitted for fixed-base laboratory analysis, only the 5.5 to 6 ft sample collected from SB104 contained detectable amounts of BTEX. This sample contained xylenes quantified at 9600 $\mu\text{g/kg}$, below the Illinois LUST Type A soil cleanup objectives (Illinois EPA, February 1993) limit of 11,750 $\mu\text{g/kg}$. PAHs occur in the soil samples collected and analyzed from the site. Subsurface soil samples contain naphthalene and 2-methylnaphthalene, while the surface soil samples contain relatively high concentrations of other PAHs, such as anthracene, chrysene, fluoranthene, etc. Naphthalene is present above the 25 ppb cleanup objective. The remaining noncarcinogenic PAHs are within the Type A objectives. Carcinogenic PAHs are above the Type A objectives. All of these compounds are potentially associated with fuel releases from the USTs, or from past reported fuel spills. Six of the nine surface soil samples contain lead in concentrations greater than 15.1 mg/kg, the upper range of the background surface soil samples. Lead concentrations detected in the subsurface soils do not appear elevated when compared to background concentrations.

As quantified by field GC analytical methods the saturated zone around the tank pit contains relatively high levels of BTEX compounds indicative of groundwater contamination resulting from a release of JP-4. Piezometer PZ104 was installed adjacent to the tank pit area. No free phase JP-4 was observed in the piezometer. Of the four site monitoring wells installed and sampled during this field event, only the groundwater samples from MW104 contain BTEX compounds. Benzene, toluene, and ethylbenzene were all detected during the second round of groundwater sampling at relatively low concentrations, and all below any applicable state or federal regulatory limit. Naphthalene was also detected in groundwater collected and analyzed from MW104 during both rounds of groundwater sampling. Concentrations of lead in the groundwater are comparable to what was found in MW102, the sites up-gradient well.

The PRE for Site 1 indicates that no immediate endangerment to human health or the environment exists due to the presence of chemicals in the soils or groundwater at the site. Based on the results of this SI, the groundwater contamination has not migrated from the site and the contaminant concentrations in the groundwater do not exceed ARARs. Based on this evaluation, there does not appear to be any immediate threats to down-gradient drinking water wells or surface water bodies. Exposure to surface soils may occur during vegetation control; however the major exposure may occur in the future during excavation activities.

5.1.4 Site 2: Old Fire Training Area

A variety of organic compounds and elevated levels of inorganics were found in the soils and groundwater at Site 2. Construction of the aircraft parking apron immediately to the north of the site in 1989 changed the surface topography and drainage of the site considerably. Screening activities identified an area in the subsurface containing high VOCs at approximately the same location base personnel had identified, prior to the survey, as the burn pit of the FTA. Because of the construction activities, site surface and subsurface vadose zone soil appear to be comprised predominately of fill material. Soil contamination indicative of past fire training activities has been identified in two soil borings; SB206 and SB207. Subsurface soils from these borings contained BTEX at 84,000 and 1210 $\mu\text{g/kg}$, respectively. No other surface or vadose zone soil samples contained BTEX. PCBs in concentrations ranging from 770 to 2800 $\mu\text{g/kg}$ were detected in three surface and subsurface soil

samples. Pesticides were detected at low concentrations and frequencies in the subsurface soils and groundwater at Site 2. Elevated levels of arsenic, barium, lead, thallium and zinc were found in surface soils at the site. In general, levels of inorganics in the subsurface soils are not elevated when compared to background subsurface soil results.

Sediment samples collected from the pond contain PAHs (92 to 2373 $\mu\text{g/kg}$) and 1,4-DCB. Inorganics quantified in the sediment samples do not appear to be elevated when compared to SI surface soil background samples. No organic compounds were detected in the surface water samples. Antimony was detected in one surface water sample at 14 $\mu\text{g/L}$; this concentration exceed the federal MCL for antimony. No other inorganic, particularly lead, appeared to be elevated.

The sites up-gradient well MW203, and most down-gradient well MW201 contain only minor amounts of organic compounds (maximum concentrations of less than 1 $\mu\text{g/L}$). However, MW202 which was installed to confirm or deny the presence of organic contamination down-gradient of the burn pit contains BTEX and a variety of other chlorinated and nonchlorinated VOCs. Vinyl chloride, cis-1,2-DCE, and lead were detected in concentrations exceeding state or federal ARARs. The presence of chlorinated aliphatic compounds indicates that contaminants may be migrating downward in the saturated zone.

The organic compounds and elevated levels of inorganics in site soils and groundwater are likely the result of past fire training activities at the site. The data presented here suggest a majority of the original soils present when the site was used as a FTA have been removed or disturbed during construction activities.

The results of the PRE indicate that the site may pose an immediate threat to the off-site drinking wells, due to the presence of vinyl chloride in one down-gradient well. While no contamination was detected in the most down-gradient well, the potential exists for the groundwater to flow underneath the pond and move toward drinking water wells. The worst-case scenario evaluated for ecological risk indicates that aquatic life present at the residential ponds would be at risk if the contaminant concentration in the ponds approaches the groundwater contaminant concentrations.

5.2 RECOMMENDATIONS

5.2.1 Site 1: POL Storage Area

According to Base Civil Engineering (CE) personnel, the USTs at Site 1 will ultimately be removed from the site. It is recommended that no additional investigative activities be performed before proceeding with the UST removal. If allowed under the Illinois LUST regulations, or necessary for groundwater remediation design, piezometer PZ104 could be sampled to quantify VOC, SVOC, and lead concentrations in the groundwater near the tank pit area. The existing site monitoring wells (MW101 through MW104) are well placed to monitor the down-gradient movement of the dissolved hydrocarbon plume existing in the shallow groundwater.

5.2.2 Site 2: Old Fire Training Area

It is recommended that a RI be performed at Site 2. The RI will define the nature and extent of soil and groundwater contamination that exists at the site. In addition, a quantitative, baseline risk assessment would be performed during the RI. The recommendation to perform a RI is based on the presence of carcinogenic COPCs (vinyl chloride) in the groundwater at the site in concentrations

above the state and federal MCLs. Although MW201, the most down-gradient well at the site, is free of organic contaminants, groundwater containing organic or inorganic compounds could be flowing beneath the pond and off-site. The down-gradient migration of COPCs within the groundwater may be adversely affecting water quality for the domestic groundwater users located approximately one quarter of a mile southeast (down-gradient) of the site. The detection of vinyl chloride in close proximity to the boundary of the airport property is an immediate concern for the water quality of down-gradient residential wells. While more data is needed to completely characterize the site, the determination of the presence or absence of a health threat in the drinking water should be evaluated immediately.

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